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"*Account of the Railway from Amsterdam to Rotterdam, and of the principal works upon it.*" *By the Chevalier* FREDERICK WILLEM CONRAD, M. Inst. C. E.; *translated from the French, by* CHARLES MANBY, Assoc. Inst. C. E. Secretary.

This railway, the first that has been constructed in Holland, is due to the enterprise of a public company, called "The Railway Company of Holland," whose affairs are managed by a council of administration, consisting of five commissaries and the engineer. The difficulties of construction, arising from the peculiar physical character of the locality, were amongst the least that the company had to contend against; the directors were, however, satisfied that the utility of the undertaking would be finally understood in the country, and that by perseverance every obstacle would be overcome.

The company was formed on the 8th of August, 1837, at Amsterdam; and, within a short period, the statutes received the royal sanction. but, no sooner had the contract been made for the execution of the first division, from Amsterdam to Haarlem, than numerous law-suits arose, owing to the hostility of the proprietors of the land over which it was intended the railway should pass,—the consequent difficulty of expropriation,—and serious discussions with the engineer, to whom, at that period, the execution of the line was entrusted, and which terminated in his resignation, caused great delays, which were prejudical to the undertaking.

At length, the government, at the request of the council of administration, appointed the author of this paper "Engineer director," and he entered on his duties in March, 1839. After a minute inspection

of the line, he found it necessary to complete the first division between Amsterdam and Haarlem, according to the designs of the former engineer; but to adopt different and more eligible plans for all the other divisions. The first part was opened on the 20th September, 1839; and the dispatch that had been used, enabled the council to announce, at the general meeting held in April, 1840, their intention to continue the execution of the remainder of the line, without delay.* The assent of the government being granted, the greater part of the year 1840 was occupied in gaining the concurrence of the regencies of the different towns and the "polders"† through which the railway would pass, and in effecting the expropriations.

In the beginning of the year 1841, the first contract for works was made, including the bridge over the river Spaarne, at Haarlem. This bridge, which is of iron, has six openings; the piers are of brick-work, faced with cut stone. The two middle openings have an iron swing bridge of a very simple and solid construction, which opens and shuts both openings at the same time, to render the passage of vessels as rapid as possible; as between fourteen and fifteen thousand pass through annually. The principal beams of this swing bridge are each upwards of 23 metres long (= 75 feet 6 inches,) and were cast in a single piece; the whole bridge weighs upwards of 110 tons; and the machinery for moving it is so perfect, that one man turns it easily in two minutes. There is also a method of holding the bridge firmly shut during the passage of the train, at which times alone it is closed, and a self-acting signal is attached to it. During the construction of this bridge, the channel of the river was diverted, that the navigation might not be interrupted, and the whole was completed in one season.

There are also five fixed bridges, of the same style of architecture, over the canals within the town of Haarlem, the station at which place is neat and simple.

After much difficulty in obtaining possession of the land for the railway, a contract for the cuttings and embankments, at a given price per cubic metre, was made, to be executed as fast as each individual portion should be obtained, either by private purchase or otherwise; by this means, much time was saved, and the line was completed to Hellegom, during the season of 1841.

At Vogelenzang, near Bennebroek, the canal of Leyden, and the high road are both crossed by a trellis bridge of 54 metres in length (= 177 feet,) at an angle of 30° with the canal. This bridge is built entirely of red deal, excepting the roadway beams, which are of oak, and is

* The divisions of the line are—

		Metres.	English.
1°	From Amsterdam to Haarlem	16814.40 =	18381.4
2°	" Haarlem to Leyden,	28270.30 =	30891.1
3°	" Leyden to the Hague,	15303.80 =	16726.2
4°	" the Hague to Rotterdam,	24000 =	26232.0
	Total,	84391.50	92230.7

or about 52½ English miles; with fifty-eight bridges in the three first divisions.

† The "polders" are the spots of land which have been drained and are now cultivated: their level is usually below that of the sea.

formed by three series of planks, crossing each other in the form of trellis-work; there are three openings, of which, those on either side are each 98.5 metres (= 328 feet 4 inches) span; and the centre one is 34 metres (= 111 feet 6 inches) span; the trains pass without causing any vibration.

The next step was, to make a contract for the trussed timber bridge, to cross the towing path, at an angle of 60°, near Leyden; for which the span was required to be 17.20 metres (= 56 feet 5 inches.)

Near this spot is the "Warmonder Leede," one of the navigable canals, which, at the same time, act as drains for conveying water from the interior of the country, into and out of the lake of Haarlem, by the dykes of Katwyk, as well as serving for commercial and agricultural purposes. The Regency of Rhynland insisted, that the bridge to cross this canal should have five openings, each of 6.30 metres (= 20 feet 10 inches,) of which the centre one should have a swing bridge for the facility of the navigation of the canal.

This is of a novel construction, on the system of a sliding bridge; it is built of timber, and the platform is easily moved by one man.

The nature of the soil from the "Warmonder Leede" to the town of Leyden, was such as to render it necessary to form the railway on fascines or faggots. This plan was also necessary on all the first part of the line; and even at the Leyden station, the whole of the buildings were erected upon a similar foundation, which appears to answer very well.

Beyond Leyden, the railway crosses the Rhine at an angle of 82°, by a trussed timber bridge with five openings; the three centre ones have each a span of 10 metres (= 32 feet 10 inches,) and the two side ones are each 6 metres, (= 19 feet 8 inches) span. One of these latter is for the navigation of the river, and is furnished with sliding platforms opening both ways; they are easily managed by one man.

It was not until the end of the year 1841, that the company obtained possession of part of the line of railway at Sloterdyk, in the first division, after a law-suit of four years' duration, relative to the expropriation: and, after being obliged to pay a large sum to the proprietor, for the permission to pass, temporarily, during the law-suit; without which, the first division between Amsterdam and Haarlem could not have been opened.

These difficulties were encountered throughout the whole line, to such an extent, that, at a short distance from Leyden, the obstinacy of a single land-owner entirely stopped the progress of the works, and obliged the company to build a temporary station for that town; without this step, the opening of that part of the line would have been retarded for three or four years, there being no legal means of accelerating the process of expropriation. The line was then opened from Haarlem to the immediate neighborhood of Leyden.

In the course of the year 1842, the whole of the second division, and great part of the third, were completed. Several aqueducts, five large bridges, and a number of small ones, were built; the latter being all over navigable canals, were made to swing on simple brackets; the permanent station at Haarlem was completed; the foundations

were laid of those of Leyden and Amsterdam; and the workshops for the repairs of the engines, &c., were finished.

These circumstances are only mentioned to shew, that, considering the delays occasioned by the defective jurisprudence in the matter of expropriation, more than common diligence had been used to enable the line to be thus far opened.

After the opening of the second division, several of Stephenson's new patent locomotive engines were added to the stock of the company; and, after ample trial of their qualities, they were considered to be the best engines in the service.

A part of the third division was opened as far as Voorschoten, in the month of May, 1843, and thus, with the aid of omnibuses and diligences, the line was completed as far as the Hague, although, owing to the legal difficulties already named, the swing bridge to cross the Hague and Delft canal could not be constructed, nor the permanent station at the Hague be built. These latter works have only been completed in this present year, (1844.)

Such were the difficulties the company had to contend with, from the delay caused by the defective state of the law of expropriation, and the rapacity and prejudice of the proprietors, over whose land the line had to pass, that it was only on the 6th December, 1843, that the railway was completely opened for public use, all the works, as well as the different stations being completed, and a simple and effective system of management established.

The opening of the railway took place, with much ceremony, on the day above named, being the anniversary of the birth of the King, in the presence of his excellency the Minister of the Interior, who was conveyed by it from the Hague to Amsterdam, where, on the same day, he was present at the opening of the Rhenish Railway, from Amsterdam to Utrecht.

The stock of the company now consists of thirteen locomotive engines, with their tenders complete, and one hundred and three carriages of three different classes, which number will be considerably increased.

From the opening of the different divisions, up to the 1st December, 1843, the locomotive engines have traversed a distance of 386,124 kilometres (= 239,786 English miles,) and 1,513,935 passengers have been conveyed.

In consequence of the difficulties experienced through the defective law of expropriation, a petition for its revision was presented to the States General, and, from its favorable reception, it is presumed that such a law will be passed, as will facilitate the formation of railways throughout the kingdom, and will cause the speedy extension of the present one as far as Rotterdam, thus uniting two cities so long celebrated in the annals of commercial enterprise.

The rails used in the permanent way are of a bridge form, weighing 30 kilogrammes per metre (= 60 lbs. per yard;) they are fixed by screws, upon longitudinal timber bearings, of Riga red deal, with sleepers of the same timber, halved into them, and secured by oak wedges. The ends of the rails are fastened by nuts and screws,

through the longitudinal bearings, with joint plates and cramps. This method of fastening is said to be very complete, and the motion of the carriage over the joints is without shock. The gauge is 2 metres (= 6 feet 6 inches English) from centre to centre of the rails; and the cost of each kilometre (= 0.616 of an English mile) of single line of railway laid, is 17,700 florins (= £1475, or £2,394 10*s.* per mile.)

The general width of the top of the earth-work for rails is 9 metres (= 29 feet 6 inches English.) The inclination of the slopes of the embankment is twice its vertical height. The side benches vary in width between 1 metre and 2 metres (= 3 feet 3 inches and 6 feet 6 inches English.) The ditches are 4 metres (= 13 feet 1 inch English) in width, and the ballasting is composed of sea-shells.

In marshy spots, all the earth-works are laid upon beds of fascines, more or less extensive, according to the nature of the ground. In those situations where the railway traverses pools of water, the fascines alternate with beds of rubble, and are held together by stakes and wattles, until the weight of the earth is laid upon them and the mass is consolidated. The earth-work is chiefly composed of sand from the sea beach, and is covered with turf.

The station at the Amsterdam terminus, is a semi-circular building of brick and cut stone, with projecting wings and sheds on iron columns, founded on piles in the usual Dutch manner.

The station at the Haarlem terminus is also of brick and stone, but is not founded on piles as the ground was sufficiently solid to bear a building.

The Leyden station, which is of the same construction as the others, stands on such bad ground, that it was necessary to construct a raft, placed upon oak piles, to receive the foundation of the building.

The station of the Hague resembles the others, but being constructed on good ground, piles were not necessary.

The bridge over the Spaarne at Haarlem consists of six arches of 8 metres (= 26 feet 3 inches English) span each; four of them are fixed, and the other two are occupied by a cast iron swing-bridge, which generally remains open for the convenience of the navigation, and is only closed at the times of the passage of the trains. The machinery for turning this bridge, and for simultaneously opening or shutting both arches, is situated on the centre pier, which is constructed, like the others, of brick and cut stone, upon piles of pine. A self-acting signal is attached to this, and to all the other swing bridges, in order to show their position.

The bridge-keepers reside in two small wooden lodges, built in the river, opposite to each end of the centre pier. The bridge being equally balanced upon the pivot, the labour of working it is small, as compared with that required for working a half-arch swivel-bridge; and it possesses the far more important advantage of perfect stability and freedom from vibration, when once fixed between its bearings—an indispensable condition for a railway bridge.

The foundation piles of the piers are from 8 inches to 11 inches square, and 26 feet 3 inches long. On these piles are laid the longitudinal beams of a timber apron, which traverses the whole of the

openings, and extends above and below the bridge, to the extremities of the cut-waters, and on these are placed the transverse bearers of the piers. The whole of the foundation is of white deal.

The following are the principal dimensions:—

	Ft.	In.	
Thickness of the centre pier,	21	10	Eng.
" " piers nearest to the centre on each side,	7	4	"
" " " " " abutments,	6	6	"
Length of the iron swivel-bridge,	77	6	"
Width of ditto,	20	10	"
Length of the middle girder,	77	6	"
" " intermediate pair,	76	6	"
" " outside pair,	74	9	"
Depth of the girders at the centre,	4	0	"
" " " " ends,	1	0	"
Thickness of the three middle girders,	0	$2\frac{3}{8}$	"
" " outside pair,	0	$1\frac{1}{2}$	"
" " oak planking of the platform,	0	3	"

The castings were made at the foundry of Messrs. Dixon & Co., at Amsterdam.

The cost of the bridge was 83,000 florins (= £6916 13*s.* 4*d.*) All the details of dimensions and cost are given.

The timber bridge at Vogelenzang is built on the American trellis-work system; it is 54 metres (= 177 feet 2 inches English) long by 9.92 metres (= 32 feet 6 inches English) wide, and spans the high road and the canal, with its towing path, at an angle of 30° with the latter. The piers are of masonry upon piles.

The timber-work consists of three ribs of lattice-work, one on each outer side of the platform and one in the centre, between the two lines of rails. Each series consists of battens of red Riga deal, 3 inches thick and 12 inches wide, crossed at an angle of 45° with the horizon, and therefore at right angles with each other, as shown in the elevation, and well fastened at each crossing, with oak trenails. More than one-third of the depth of the lattices is below the platform; and its general stability is very much increased, and lateral vibration is prevented, by the diagonal trussing shown in the transverse section and plan of the platform. The transverse oak bearers, 10 inches square, on which the planking of the platform is laid, are placed at intervals of about 3 feet, every alternate one being trussed, as shown in the section, and the truss bound together by a pair of iron screw-bolts, 4 feet long, placed between the longitudinal bearers of the rails. The planking of the platform is of white deal, 3 inches thick and 20 inches wide; and, excepting this and the oak bearers of the platform, the whole of the timber-work is of red Riga deal.

The following are the principal dimensions of the parts:—

	Ft.	In.	
Length of the bridge,	177	0	English.
Total width of ditto,	32	6	"
Width of side openings,	29	0	"
" middle opening,	111	6	"

	Ft.	In.	
Height of the platform,	15	9	English.
" " lattice above ditto,	7	10	"
Depth of the lattice below ditto,	5	2	"
Total height of the lattice ribs,	13	0	"
Clear width of each roadway,	13	0	"

This construction is stated to be very satisfactory, and to have cost only 46,000 florins (= £3832 6*s.* 8*d.*)

The trussed timber bridge over the Warmonder Leede, crosses the river at an angle of 50°. It has five openings of 6.30 metres (= 20 feet 8 inches English) each; through one of these, the navigation is carried on, and it is closed when the trains pass, by a sliding platform moving diagonally upon rollers, which is worked by one man, and by very simple mechanism, like that of the double platform bridge at Vink.

The heads of the piles for this bridge require to be cut off, and a tenon to be worked upon each, below the water line: this was done by a simple apparatus, consisting of a deal box, well put together and caulked, so as to be water tight; it was 2 metres (= 6 feet 6 inches English) long, 1.30 metre (= 4 feet 3 inches English) wide, and 1 metre (= 3 feet 3 inches English) deep. Through the centre of the bottom there was a hole large enough to admit the head of a pile. Around this hole was nailed the open bottom of a sack of stout canvas, strengthened with leather. Two cords were made fast, by one end of each, to the box, and the others were passed through pulleys in the sides.

When a pile was required to be cut off, the box was put over it, and by weights within, it was caused to descend as low as was requisite; by means of the two cords, the lower end of the sack was then drawn round the pile, so as to form a water-tight joint; by a small pump, the water was then emptied from the box, into which a workman descended, turned back the canvas sack, and after sawing off the pile, cut the head into any desired form.

This system is stated to have been used wherever the piles were required to be cut off under water, and to have been very successful.

The cost of the bridge over the Warmonder Leede was 44,600 florins (= £3716 13*s.* 4*d.*)

The trussed timber bridge, which crosses the canal and the towing path near Leyden, at an angle of 60°, is fixed, and has a span of 17.20 metres (= 36 feet 5 inches English.) Its cost, with some accessory works, was 34,800 florins (= £2900.)

The trussed timber bridge over the Rhine, near Vink, beyond Leyden is at an angle of 82° with the stream; it has five arches, three of which have openings of 10 metres (= 32 feet 10 inches English) each, and the two side arches are 6 metres (= 19 feet 8 inches English) each; one of these latter, which is intended for the navigation, is closed by two parallel platforms which slide diagonally in opposite directions; when opening, they are moved simultaneously by one man, with very simple machinery. The cost of this bridge was 41,200 florins (= £3433 6*s.* 8*d.*)

The single swivel bridge over the Delft canal at the Hague, is of cast iron, and spans the canal at the angle of 72°, with only one opening of 8 metres (=26 feet 3 inches English.) The piers are of masonry, founded on piles. Its cost was 31,000 florins (£2583.)

The railway necessarily passes over numerous canals, whose traffic must be provided for; it was consequently requisite to provide a cheap and simple mode of crossing them; the author therefore devised a peculiar form of bridge, and has called it the "turn rail bridge."

Four timber bearers, 12 inches deep by six inches wide, carry the two lines of rails; they are jointed on to heel posts of oak, shod with iron, which turn upon centres, on plates set in the masonry of the abutment. The bearers are further supported by brackets of cast iron; and each pair is connected by two bars, turning on joints, to preserve the parallelism of the rails. Each pair opens outwards, for the passage of the boats; and when they are closed, the ends of the bearers rest in recesses, prepared in the masonry for their reception, in order that the ends of the movable rails shall coincide with those of the fixed ones. This form of bridge is very cheap, and is found to answer well for a span not exceeding 16 feet.

The population of the towns through which the railway passes, is stated thus:

Amsterdam	213,349	inhabitants.
Haarlem	24,012	"
Leyden	37,464	"
The Hague	63,556	"
Delft	17,037	"
Scheidam	12,051	"
Rotterdam	78,098	"
Total	443,567	"

A tabular statement is given of the number of travelers, and the amount of the receipts since the opening of the railway.

Years.	Travelers	Receipts.					
		Florins	Cts.	£	s.	d.	
1839	77,763	41,765	19 =	3,480	8	7¾	1st division opened September 20th, 1839.
1840	319,994	168,333	30 =	14,069	8	10	1st division alone worked.
1841	292,556	136,698	61 =	11,399	17	8	Ditto. ditto.
1842	364,681	210,574	34 =	16,714	10	6¾	2d divis'n opened to Veenenberg June 20th, and to Leyden Aug. 17th.
1843	466,498	335,898	90 =	27,991	10	6	3d division opened to Voorschoten May 1st, and to the Hague Dec. 7th.
	1,550,892	893,770	34 =	73,655	16	2½	

There is also a statement of the number of locomotives employed, their power, sizes, and number of wheels, the makers' names, the number of miles run over, with many other particulars.

A detailed statement is also given of the lengths and height, above the datum line (AP)* of every portion of the three divisions of the railway which are opened, with particulars of all the bridges and other constructions.

This communication is illustrated by a section and plan of the line of railway; a map of part of Holland; and one of the city of Amsterdam; also, a series of lithographic drawings of the bridges and other works on the line; and a model of the turn-rail bridges, to be seen in the society's library.

In a letter to the Secretary Inst. C. E., dated May 4, 1844, Mr. Conrad says: "At the last meeting of the shareholders, on the 26th April, we were authorized to borrow 2,500,000 florins (=£211,750) for finishing the fourth division of the railway, or that part between the Hague and Rotterdam. I shall therefore commence immediately the execution of the works, the plans for which I have already laid down. We expect that a new law of expropriation will be passed, and when the States General have conferred upon us that benefit, we shall see the works carried on with increased vigor.

"Since the opening of the railway, as far as the Hague, the improvement in the value of the shares has been very great; the price in December, 1843, was 56 florins, and is now from 98 florins to 99 florins; and the shares will speedily be at a premium.

"The comparison of the number of travelers and of the amount of receipts in similar months of 1843 and 1844, is curious.

	1843.		1844.	
	Travelers.	Florins.	Travelers.	Florins.
January	17,439	12,929	35,213	30,968
February	18,912	14,276	34,203	29,345
March	21,965	16,589	39,498	36,040
April	27,329	20,503	51,698	47,651

"The tariff of fares is also altered to the following rate:—

				d.	
First class,	5 cents	per kilometre	per passenger	=1.66	per mile.
Second "	4	"	"	=1.33	"
Third "	2½	"	"	=0.83	"

This alteration has been found very profitable, as a greater number of passengers now travel in the first class carriages."

Trans. Inst. Civ. Eng'rs.—London Jour. Arts and Sci.

* AP. (Amsterdam Pile,) a fixed water level adopted by the Government as a datum line in all the hydraulic works in Holland.

The Hungerford Suspension Bridge.

This bridge was opened as a public thoroughfare across the Thames, from Hungerford market to Lambeth, on the 1st of May. The following particulars of the bridge, are from a lecture at the Royal Institution, delivered by Mr. Cowper in April. We extract from the *Athenæum*. This bridge is for foot passengers only: it consists of four broad chains, viz., two chains, one above the other, on each side of the platform; each chain consists of ten and eleven links alternately, and, near the piers, of eleven and twelve. This increased strength is to meet the increased strain which takes place near the piers. The chain of the Menai Bridge is only five links wide, and the chain of the Hammersmith only six links wide; but the great breadth of the Hungerford chain (viz., eleven links, or about two feet,) gives them great power to resist the effects of the wind, and thus to prevent vibration. Two brick piers, in the Italian style, are built in the river, over which the chains are carried, forming thus a central and two side spans.

The two piers are in height, ...	80 feet.
The central span between the piers, (being 110 feet wider than the Menai Bridge,)	676½ feet.
The length between the abutments, . . .	1352½ feet.
Deflection of the chain, ...	50 feet.
Length of each link, (7 in. wide, 1 in. thick,) . .	24 feet.
Weight of each link, ...	5½ cwt.
(The connecting pins are 4⅝ inches diameter.)	
The whole number of links, ...	2600
Their weight, ...	715 tons.
Width of the platform, ...	14 feet.
Height above high water at the centre of centre span,	32½ feet.
——— near the piers, ...	28½ feet.
(Giving a rise of four feet in the centre. This gives additional height for the river traffic, and produces a graceful curve, and prevents any appearance of swagging.)	
The section of the chains at the centre of centre span is	296 sq. in.
——————— near the piers, ...	312 sq. in.

A square inch of iron *breaks* with 27 or 29 tons, but 17½ tons is taken as the *impairing* weight, *i. e.* the weight at which it begins to stretch; we have, therefore, for the weight the bridge will actually bear,—

$$296 \times 17\tfrac{1}{2} \text{ tons} = 5180 \text{ tons},$$

while 296×5 tons $= 1480$ tons,

is the greatest load that can be put upon it. This is taking a crowd standing close together to be 1000lb. per square foot. The entire weight of the chain, the platform, and a full load upon it, would make a load of about 1000 tons on each pier, being about 8½ tons on each square foot of brick-work, or not quite 1¼ cwt. on each square inch. The chains are attached to large wrought-iron vertical plates

at the summits of the piers: these plates are firmly bolted together, and also to a strong horizontal plate,—the whole forming what is called a saddle. The saddle is not fixed to the pier, but rests on fifty friction rollers, these resting on a thick iron plate, which is supported by a solid mass of iron and timber girders. The pier itself, being pierced with arches, may be considered to consist of four columns of brickwork; the girders, therefore, are so arranged that no weight is thrown on the *arches*, the whole weight resting on the columns. The saddle is capable of moving eighteen inches each way, equal to three feet entire motion; so that if either span were crowded, the chains would adjust themselves, and the strain be still perpendicular upon the piers, and have no tendency to pull the pier over. The method of putting up the chains was thus:—Two sets of *wire* ropes, each consisting of three ropes, were hung from abutment to abutment over the piers, in the exact situation the chains were to occupy,—these *scaffold* ropes, as they may be called, being distant from each other equal to the length of the connecting pin. A few feet above the scaffold ropes, two other ropes were hung in like manner; on these traversed two light boxes, very much resembling a carpenter's bench turned topsy-turvy. These *cradles*, as they are called, were connected together, and contained two windlasses, like those over a common well; these cradles held the workmen. A barge containing the links was moored under the cradles; four men in the cradles hauled up a link; and when they had raised it above the scaffold ropes, the connecting pin was put through, and the pin being allowed to rest on the scaffold ropes, of course supported the link. The cradles were then moved forward, and two links joined to the single link, then one joined to the two; the chain consisting thus, in the first instance, of alternately two and one links. When this two-and-one-link chain was completed, the scaffold ropes were not required, the two-and-one-link chain forming, as it were, a scaffold for the rest of the links; and thus was this bridge erected *without any scaffolding* but these few ropes, and without the slightest impediment to the navigation, and without a single accident. The cost was—

Brick work,	£63.000,	by Mr. Chadwick.
Iron work,	17,000,	by Sandys, Carne & Vivian.
	£80,000	

The money was raised by—

3200 Shares of £25 .	£80,000
By Loan, .	26,000
	£106,000

Engineer in chief—Sir I. K. Brunel. Resident Engineer—Mr. P. Pritchard Baly.

Glasgow Prac. Mec. and Eng. Mag.

On the Peculiar Features of the Atmospheric System.

A paper was read by Mr. Berkeley, which consisted of a series of questions on the "peculiar features of the Atmospheric System," and

had for its object to elicit opinions upon the comparative practical advantages and disadvantages of the atmospheric and locomotive systems. The chief points which were raised consisted of the mechanical difficulties in the application of the atmospheric system to level crossings and sidings, and the performing the work at the stations, &c., which, in spite of the ingenious device of the engineers who had adopted the system, appeared to entail cost and complexity. The advantages and economy of frequent trains on short lines were admitted, but it was stated that the same plan could be practised with locomotives without any disadvantage. For a long line, the benefit of the plan was questioned. It was shown that greater safety did not exist even on single lines, when the circumstances were equal, and the electric telegraph applied to each; in fact, that when the whole position was considered, the balance of advantage of probable freedom from accident, would appear to be somewhat in favor of the locomotive system: that greater speed had not been usually attained, or that if attained it must involve "inordinate cost." The facility for surmounting steeper gradients was questioned, and the inference drawn, that the enormous first cost would confine the application of the atmospheric system to the same narrow limits as were occupied by other stationary systems; and that it must be classed with them only as a means of overcoming lengths of such bad gradients, as did not come within the limits of locomotive power, or where the lines were short and the traffic was great, terminal and simple. In adverting to the cost of maintenance, the comparative advantages of the two systems were examined, and it was argued, that it was fallacious to compare the expense of keeping up the Dalkey line, which was excavated in rock, and resembled "an uncovered stone drain," with that of maintaining the Dublin and Kingstown Railway, which was a sea embankment, stretching across a part of the bay, and on which the trains were not unfrequently stopped by the waves. An examination was entered into, of the difficulty of removing the earth from slips, or doing any of the usual quantity of contractor's work on the line, without having recourse to locomotives; on this point, the observation of Mons. Legrand, the French Minister of Public Works, might be quoted. On his return from inspecting the Dalkey Railway, he said that there could not be any doubt of the applicability of the atmospheric system to some positions, and probably with advantage, "mais après tout il fallait avouer ce n'était pas un cheval à la main, comme la machine locomotive." In the discussion which ensued, the theory propounded by Dr. Robinson in his recent examination before the Parliamentary Atmospheric Railway Committee, that "a steady uniform height of barometer had nothing to say to the velocity," or did not indicate, as Mr. Stephenson had stated, in his report, "a maximum uniform velocity," was examined, and it was admitted that the case which he proposed in illustration of his theory, was practically impossible, and was irrelevant to the subject. The supposition of the existence of a perfect vacuum in front of the piston, would throw aside the question of the uniform action of the machinery, with an accelerating motion of the train, which, it was

shown, must produce an unsteady height of the barometer; the condition of a steady height could not exist, unless both the power of the resistance due to the velocity, were either equally irregular or regular; in either case an exact balance being maintained. In Mr. Stephenson's experiments, the circumstances of regular power and steady height of the barometer, were shown to exist simultaneously, and the inevitable inference was that a regular uniform maximum velocity was obtained. Dr. Robinson's case was allowed "to have been stated only for the sake of argument," but a practical inconsistency in Mr. Stephenson's experiments of a steady height of barometer with a slight accelerating velocity, was put forward as condemnatory of his report, on the supposition that it was more practicable to note the velocity than to observe the indication of the barometer, and that the true reason for this slight acceleration, was the shortness of the line, and that hence no accurate result could be arrived at.

The question of the loss arising from the evolution of caloric in the air pump, due to the condensation of the air from its rarified condition in the tube to the density of the atmosphere, was considered, and was admitted to be at least as great as had been stated by Mr. Bergin.—*Proc. Inst. Civ. Eng.* Athenæum.

Roman Tunnel at Marseilles.

In your number of February 8th, there was a short notice from the French papers of a very curious tunnel, supposed to be of Roman construction, which had recently been discovered under the mouth of the harbor at Marseilles, connecting the two forts of St. Jean and St. Nicholas. I have just returned from Marseilles, and while there made inquiry for the tunnel, and was assured that they had first heard of such a structure from the Paris papers. This is not the first time, either, that such a report has been spread. There appears to be some tradition that such a thing does exist, but no discovery of the kind has yet been made.

I am, &c., PHILIP N. BROCKEDON.

April 14, 1845. Athenæum.

Report of the Engineer in Chief of the Georgia Railroad and Banking Company, to the Stockholders in Convention, May 17th, 1845.

Engineer's Department, Geo. R. R. & Banking Co.,
Augusta, May 1st, 1845.

To the Hon. Jno. P. King, President:

Sir:—Since the date of my last annual report, our road has been extended to Covington, twenty-six miles west of its former terminus at Madison. During the same period, the graduation and bridging upon the whole line, with some immaterial exceptions, have been completed.

The wood work of the superstructure will be laid in a few days, continuously to the Little Stone Mountain, 17 miles above Covington.

and the iron (which has been delayed by the Yellow River Bridge) to a point some six miles beyond the river. To get thus far, we have had to require the iron to be wagoned across the river, at the expense of the bridge contractor. Within a week, however, the bridge will be finished so as to pass the trains, and there will then be no farther interruption to a rapid continuation of the work to its final terminus.

The following statement will show the amount expended on account of the extension of the road, up to this date :

For Graduation and Culverts, - - - -	$ 264,708	95
" Bridging, - - - - - - - - -	48,559	42
" Superstructure, (including duty on iron,)	366,744	07
" Right of way, - - - - - - - -	17,147	84
" Real Estate, - - - - - - - - -	10,431	53
" Engineering, Depots, Wells, Divis. Houses, &c.,	24,259	30
	731,851	11
Estimated cost of road, including duty, - -	894,000	00
Leaving to be expended, - - - -	$ 162,148	89

Which amount will be sufficient to meet all further demands for construction of road, depots, &c., extend the warehouse at Augusta, and supply such *additional* machinery as may be required for the road this year.

Notwithstanding the interruption to the progress of the work, from the magnitude of some of the bridges, and the almost impenetrable character of many of the rock excavations, I have every confidence that the entire road will be ready for use by the time reported to the last annual convention of stockholders. In connection with the Western and Atlantic Railroad, (which will be finished to the Oostenaula about the same time,) we shall then have a continuous line of railway from Augusta, of 250 miles—nearly double the length of our main line in use at the present time.

The extension of the Western and Atlantic Railroad beyond the Oostenaula is, for the present, suspended, in consequence of the absorption of the state appropriation upon the road below it. It seems to me, however, that its early continuation to the Tennessee, appeals to too many of the incentives that control the actions of individuals and communities, to permit a long time to elapse before the work shall be again resumed. Without this extension to the navigable waters of the West, the state cannot expect to receive a remunerating traffic upon her road. With it, she will not only add greatly to the revenues of her work, but elevate its character, from a mere local improvement, to that of a national thoroughfare, connecting the "fertile West" with all the important markets on the Southern Atlantic slope. The completion of the road to Chattanooga, will also place the Tennessee River in the same commanding position, as an avenue of trade between the West and the Southern Atlantic States, that the Ohio now holds to the northern and middle states, and it will present

equal claims upon the general government for appropriations, to render it navigable for steamboats at all seasons, which it is understood can be effected at a much less cost than upon the Ohio.

The importance of the early completion of the improvements referred to above, to the prosperity of our enterprise, are too well known and appreciated by our stockholders to have required any notice of them in this report. But as public attention has been called to another route, to accomplish the same object, terminating on the Tennessee lower down, which may divide the friends of the work, and, consequently, delay its execution, I have thought it proper to present a few remarks on this subject, which, it appears to me, is so deeply interesting to us, both as citizens of the state and stockholders in our road.

While I am inclined to admit, that a route terminating on the Tennessee, at Gunter's landing, *would have been* preferable as the original design to that at Chattanooga, I am decidedly of the opinion, in view of the small amount necessary to complete the road as now laid out, and the impossibility of raising the capital required to build it on the route proposed, in a *satisfactory manner*, that it would be both a waste of time and money, to deviate from the present track.

In expressing doubts whether the terminus selected for the state road on the Tennessee, at Chattanooga, was the best that could have been obtained, I am not insensible to the many and strong reasons which influenced its choice, and must confess, that even with all the lights now before me, any preference entertained for the Gunter's landing route, would be surrendered, if the navigation of the river between these points should be perfected. The whole of North Alabama and Tennessee would then be accommodated, and by a short branch to Rome, the rich valley of the Coosa would also be drained.

The business of the road, and the expenses incurred in working it, during the year ending on the 31st of March, are shown in the following summary statement. A statement in detail of the several accounts below, will be found among the accompanying papers.

Business.

Passengers up,	$ 40,234 75	
" down,	34,017 80	
Freight up,	72,033 21	
" down,	90,121 67	
United States Mail,	1,960 32	
Extra Trips with passengers, &c.,	33,381 77	
		$ 271,749 52

Expenses.

Conducting Transportation,	$ 32,280 67	
Motive Power,	28,724 13	
Maintenance of Way,	45,054 60	
Maintenance of Cars,	16,252 38	
	122,311 78	

Carried over.

Amounts forward,	$ 122,311 78	$ 271,749 52
Deduct estimated actual outlay for transporting 3,300 tons of iron, wooden rails and mud-sills, at $1 50 per ton,	5,100 00	
		117,211 78
Leaving nett profits,		$154,537 74

The expenses of the road, as anticipated, are greater than they were last year, in consequence of higher wages paid for labor, and the increased business of the road, together with the necessity of substituting larger axles for many of those first put under the cars. The excess of down freight over the up, compared with the previous year, has also added to the expenses a greater per centage than to the receipts. The difference, however, is only 3 per cent. The expenses last year being 40 per cent of the receipts, and this year 43 per cent.

If we take the number of miles run by the trains to perform the year's business, the comparison shows favorably with any previous period. The following statement gives it for the last two years :

		1844.	1845.
Conducting Transportation per mile run,	cents,	17.50	16.50
Motive Power, " " "	"	16.80	14.70
Maintenance of Cars, " " "	"	06.75	08.25
Maintenance of Way, " " "	"	25.	23.
Total,	"	66.05	62.45

The transportation on the road, including iron and lumber for the extension, and exclusive of materials for repairs of road, &c., is equal to 2,352,896 tons carried one mile. Exclusive of materials for the extension, it is 2,022,896 tons; which gives the cost of transportation, dividing the expenses between the passenger and freight trains according to the distance run by each, on the main line, and calling the Athens train a freight train, three and one-quarter cents per ton per mile. The cost of transporting passengers (making due allowance for the mails) is two and one-third cents per passenger per mile. The cost of transportation, per ton and per passenger, here given as the deduction from our past year's business, is not to be taken as a criterion of the cost of carriage on railroads. This is mainly dependant upon the amount and character of the business done; and without a knowledge of these facts, no comparison can be made with other works. With double the amount of freight, our expenses would probably not have exceeded two cents per ton per mile; and if it had been received in such quantities as to have ensured loaded trains each way, one and one-half cents per ton would have covered expenses.

The cost of keeping up the road, estimating the average length of road in use during the year, at 155 miles, is $290.60 per mile. Last year it was $260 per mile for 147½ miles then in operation. The length of road now in use, including 43 miles of branches, is 173½ miles. When the entire line is completed it will be 214½ miles. The cost of keeping up the road for the last two years, is below what we

may expect as an average rate. But I do not believe that it will, at any time, exceed $350 per mile, unless occasioned by some extraordinary casualties, or the necessity of greatly increasing the speed of our trains, when it will be important to keep the track in more perfect adjustment.

The charges upon the books of the Bank, against the business of the road, up to this date, May 1, 1845, are $ 179,612 23

The actual expenses, (including the transportation of iron,) are 122,311 78

Leaving, $ 57,300 45

Which is accounted for by materials furnished and work done for the road, at the shops, as follows:

Cars built previously to April 1st, 1844, and not charged,	$ 4,691 99
34 Burden Cars built since April 1st, 1844,	17,750 00
Extension of Machine Shop 70 feet,	1,158 30
Extension of road—Alcovy Bridge,	3,567 31
Wood's Mill Bridge,	739 15
Bolts, Spikes, &c.,	961 26
Superstructure,	244 31
Materials *on hand*, for repairs of road and for car and engine work, at shops, purchased since April 1st, 1844,	24,900 29
Disbursements to date, on account of business of 1845 and '46	3,287 84
Amount as above,	$ 57,300 45

The unusually large amount of materials on hand, consists in a great measure of car wheels and bar and pig iron, which was purchased in view of an anticipated rise in these items, and which could not now be replaced without an additional outlay of several thousand dollars.

The stock of cars on the road on the 1st of April, 1844, was, 6 passenger cars, 47 close, and 41 open burden cars. We now have the same number of passenger cars, 66 close, and 56 open burden cars. Orders have been given to construct two more passenger and 50 close burden cars, to be ready for the opening of the business upon the Western and Atlantic Railroad. This number will be further increased with the demands for their use.

We have also ordered two additional freight locomotives to be delivered during the ensuing summer. These will increase the number of our engines to fourteen, which we think will be sufficient to do the next winter's business.

The business of the road has exceeded that of last year, $23,653 08, of which the increase on up freight is $2,372 02; on down freight, $11,721 41; on passengers, $6,749 33, and mails, $2,810 32. From this exhibit it will be perceived that, notwithstanding many of our old customers have been attracted to new channels of transportation, we have been steadily drawing from other sections of the country a trade that has more than compensated for their loss. We should not, however, rest satisfied without making some efforts to remove or modify the difficulties which have caused in many instances a diversion of our trade. These difficulties arise mainly from the imperfect

connexion between the eastern terminus of our road and the sea board. Upon the Charleston route, the drayage at both ends of their road is excessive, but particularly so at this end; and from the circumstance that it comes immediately under the notice of the interior merchants, who frequently remain in Augusta to forward their goods, is particularly objectionable to them.

Whether any modification of the present system can be brought about, I am unable to state; but it seems to me incumbent upon our company, either to make some efforts to modify the objections complained of, or endeavor to make an arrangement which will insure a more perfect communication between this city and Savannah. The transportation upon the river is now not only dependant upon the stage of the water, but the freight lists of the Steamboat Companies exhibit rates for heavy articles—especially on those of little value—which, when compared with similar charges on rivers whose navigation is not more perfect than that of the Savannah, may be considered extravagant.

Upon the Ohio river, between Pittsburg and Cincinnati, a distance three times further than from Augusta to Savannah, the rates are only one-half of those on the Savannah, or one-sixth of them per 100 lbs. per mile.

Upon the Alabama river, the rates of freight are also greatly below those of the Savannah. But the chief difficulty on our river route is, the entire absence of boats calculated to run during the frequent low stages of the water. This difficulty will be considered surprising, when it is recollected that the water on the most difficult bars never, as I am informed, falls below a depth of 20 inches—a point which it reaches only once in a series of years. With this minimum depth of water, I am satisfied from the inquiries that I have made, that produce and merchandize can be transported between Augusta and Savannah at all seasons of the year, provided fair loads can be obtained each way, at a cost of five and a half cents per 100 lbs., including interest on capital, repairs, and depreciation in value of boats. If an average of only half loads, or full loads one way, can be obtained, then nine cents would cover costs, &c., &c.

The importance of this subject to the revenues of our company, will be appreciated by those who witnessed the great loss of freight sustained by the road during last season—amounting, at the lowest estimate I can make, to $15,000—probably much more.

The adjustment of our rates of freight has heretofore been assigned to the Engineer department; but as the extension of the road has greatly increased the importance and responsibility of this duty, I would respectfully suggest to the Board the propriety of appointing an executive committee to take charge of this subject.

Before another meeting of our stockholders, the enterprise upon which they have been so long engaged, will be brought to a final termination; and I trust that they will then begin to receive an adequate return for their capital invested. The period chosen for the extension of the road could not have been more propitious. Not only have we been enabled to get the work executed upon the most

favorable terms, but a timely order for our iron has given us that item at about $150,000 less than it can now be bought for.

In closing this communication, I regret to state that the company will shortly lose the efficient services of Mr. Peters, who has been associated with me, either on the construction of the road, or the management of its business, from the commencement of the work. His place at the head of the transportation department will be filled by F. C. Arms, Esq., already favorably known to the stockholders, and who has been for some time fulfilling the duties of the office, under the immediate direction of Mr. Peters.

All of which is respectfully submitted by your ob't serv't,

J. EDGAR THOMSON,
Chief Engineer and General Agent.

Statement of the aggregate amount of business done on the Georgia Railroad from April 1st, 1844, to April 1st, 1845.

MONTHS.	PASSENGERS.						FREIGHT.				MAIL.	Total.
	UP.		DOWN.		UP and DOWN.		UP.	DOWN.		UP and DOWN.		
	No. Pas.	Amount.	No. Pas.	Amount.	No. Pas.	Amount.	Amount.	Bales Cotton.	Amount.	Amount.	Amount.	Dolls. Cts.
April, 1844.	718½	$2,582 56	757	2,784 47	1,475½	5,367 03	5,924 94	1,617	2,268 74	8,193 68	2,429 17	15,989 86
May, ...	659	2,302 61	715	2,527 61	1,374	4,830 22	4,478 42	810	1,161 68	5,640 10	2,429 17	12,899 49
June, ...	649½	2,159 99	782	2,654 06	1,431½	4,814 05	2,545 56	313	707 58	3,253 14	2,429 17	10,496 36
July, ...	695½	2,199 58	771½	2,705 64	1,467	4,905 22	3,424 47	502	917 85	4,342 32	2,429 17	11,676 76
August, ...	800½	2,660 10	1,069	3,600 33	1,869½	6,260 43	3,345 69	1,119	1,593 40	4,939 09	2,429 17	13,628 69
September, .	886½	3,278 29	708	2,445 23	1,594½	5,723 52	7,320 77	2,605	3,037 15	10,357 92	2,745 82	18,827 26
October, ...	1,243½	5,171 25	802	3,022 96	2,045½	8,194 21	9,769 78	8,159	9,237 63	19,007 41	2,745 82	29,947 44
November, .	1,061	4,148 07	780	2,875 77	1,841	7,023 84	6,572 30	13,659	15,336 34	21,908 64	2,745 82	31,678 30
December, ..	1,084½	3,915 76	794½	2,625 94	1,879	6,541 70	7,610 59	11,196	11,694 22	19,304 81	2,745 82	28,592 33
January, '45	1,085½	3,848 65	757	2,581 13	1,842½	6,429 78	5,022 96	11,701	13,105 81	18,128 77	2,943 73	27,502 28
February, ..	923½	3,540 76	770	2,849 73	1,693½	6,390 49	6,093 49	15,756	18,207 26	24,300 75	2,943 73	33,634 97
March, ...	1,078½	4,427 13	859½	3,344 93	1,938	7,772 06	9,924 24	10,513	12,854 05	22,778 28	2,943 73	33,494 06
Total, ...	10,886	$40,234 75	9,565½	$34,017 80	20,451½	74,252 55	$72,033 21	77,948	$90,121 67	$162,154 88	31,960 32	268,367 75
							Way Passengers, Warrenton Branch, ...					33 64
							Extra Trips, ...					2,132 99
							Extra Baggage, &c., ...					502 23
							Lots Negroes, ...					642 75
							Freight between Stations, ...					70 16
												$ 271,749 52

Statement of the Expenses incurred for working the Georgia Railroad, from April 1, 1844, to April 1, 1845.

Conducting Transportation.		
Stationary and Printing, &c.,	$1,735 15	
Loss, Damage, (including $ 342.42 for stock killed by Trains,)	1,004 89	
Incidentals,	1,885 25	
Oil and Tallow for Cars,	178 38	
Provisions, Clothing, Doctors' Bills, &c., for Negroes,	3,244 12	
Expenses of Warrenton Branch,	586 32	
Expenses of Horse Car. Athens Branch,	1,145 35	
Wages, Laborers and Watchmen,	4,317 84	
Agents and Clerks,	13,168 56	
Conductors,	4,997 81	
Work done by Machine Shops,	16 00	
		32,280.67
Motive Power.		
Expenses of Water Stations,	2,023 57	
Incidentals,	210 19	
Wood for Locomotives,	7,602 62	
Oil and Tallow for Engines,	1,280 42	
Ordinary and extraordinary repairs to Locomotives,	5,352 50	
Engineers and Firemen,	8,381 35	
Provisions, Clothing, Doctors' Bills, &c., for Negroes,	3,348 88	
Work done by Car Factory,	524 60	
		28,724.13
Maintenance of Way.		
Mens' Wages,	16,381 97	
Supervisors,	2,380 00	
Provisions, Clothing, Doctors' Bills, &c., for Negroes,	4,154 98	
Incidentals,	86 51	
Tools,	941 33	
Spikes,	2,158 23	
Wooden Rails and Cross Ties,	17,475 60	
Work done by Car Factory,	537 00	
" " " Machine Shops,	943 98	
		45,054.60
Maintenance of Cars.		
Rebuilding Passenger Car, Covington,	1,600 00	
Repairs of Passenger and Burden Cars,	4,952 38	
New Cars in place of others worn out,	2,250 00	
Renewal of Wheels and Axles,	7,450 00	
		16,252.38
Total Expenses,		122,311.78
Deduct estimated actual cost of transporting Lumber and Iron, for 26 miles of extension of Road—equal to 3300 tons a 1.59,		5,100.00
Leaving the Expenses of the regular business of the year,		$117,211.78

LOCOMOTIVES.

Names of Engines.	Makers' Names and Class.	Commencement of Service.	No. of miles run by each engine from April 1, 1844, to April 1, 1845.	Cost of repairs to each engine, from April 1, 1844, to April 1, 1845.	Total cost of repairs and improvements to each engine, from commencem't of service to Apl. 1, 1845.	Total number of miles run by each engine from commencem't of service to April 1, 1845.	Condition of Engines.	Remarks.
Georgia, ...	No. 3	May 5, 1837	15995	238 50	5390 94	94070	In House undergoing repairs.	
*Pennsylvania, .	" " 3	" " "	36375	903 50	4833 32	164295	On Road in good order.	
Florida, ...	" " 3	Dec. 27, "	.....	.....	3526 74	60581	.....	Sold to the State of Georgia.
Alabama, ...	" " 3	Jan. 12, 1838	38010	639 00	5236 02	141230	On Road in good order.	
Louisiana, ...	" " 3	Feb. 2, "	21120	457 50	6201 80	129690	On Road in complete order.	
Tennessee, ...		May 29, "	14400	321 25	3630 46	76324	In Shops undergoing repairs.	Altered to Baldwin & Whitney's
Wm. Dearing, ..	" " 2	Nov. 6, "	17250	582 00	4376 72	92265	On Road in complete order.	Patent Freight Engine.
Virginia, ...	" " 2	Dec. 24, "	12225	340 50	4769 64	71907	On Road in good order.	
Mississippi, ...	" " 2	" 28, "	10635	506 00	3642 77	60407	On Road in good order.	
Kentucky, ...	" " 2	M'ch 24, 1839	13875	128 75	4269 22	72241	On Road in complete order.	
Wm. Cumming,	" " 2	Dec. 14, "	.....	533 75	1695 08	12575	On Road in complete order.	
James Camak, ..	" " 2	" 23, "	11760	680 75	2661 61	40965	In House in complete order.	
Athenian, ...	" " 3	Jan. 27, 1845	4110	21 00	21 00	4110	On Road in complete order.	Baldwin & Whitney's patent 6 wheel connect. freight engine of 8 tons weight.
	M. W. Baldwin & Co.		195755	$5352 50	$50255 22	1,020760		

* The Pennsylvania has run during the three years ending April 1, 1845, 106,915 miles, at a cost for repairs of 1¾ cents per mile.

AMERICAN PATENTS.

List of American Patents which issued in the month of December, 1844, *with Remarks and Exemplifications.* By CHARLES M. KELLER, late Examiner of Patents in the U. S. Patent Office.

1. For an improvement in the *Bee Hive;* Oliver Reynolds, Webster, Monroe county, N. Y., December 4.

Claim.—"I do not claim constructing the hive of several boxes, placed one above another, with communications between them, and each box having its separate and respective opening; nor the mode of ventilating. But what I do claim as my invention, and which I desire to secure by letters patent, is my manner of freeing the honey boxes from the bees; and, also, of equalizing the hives by the use of the long tube, as set forth."

This manner consists in employing a long tube, which leads out from the boxes, or hives, through which they can pass out, but will not enter, because of its projection beyond the casing.

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2. For an improvement in the *Permutation Lock*, for vaults, doors, &c.; Darius W. Maples, Geneva, Ontario county, N. Y., December 4.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner herein set forth, in which I have arranged and combined the hollow centres with their wheels and their other appendages, so constructed as to receive the change-pin, through slots, in a plate, and also to receive a set-pin; these pins, and the other parts described, being so arranged as that, by the said combination of parts, the said lock may be set by their means, and by that of the graduations on the escutcheon, and may be locked and unlocked by the application of a compound key, such as is herein described—the lock being operated upon by three sets of motions, as set forth. The combination and arrangement, as a whole, being substantially such as is herein fully made known; not intending, however, to limit myself, by this claim, to the precise number of divisions, or other parts, which govern the extent of the different permutations which may be made by means of a lock constructed upon this principle, but to vary these to any extent which I may deem proper, whilst the arrangement of the instrument is such as to preserve the same principle of action, and the same combination of parts."

The key, in this case, is composed of a tube turning on a spindle, each being provided with a separate handle, and capable of being connected with the "hollow centres," that either may be turned at pleasure. The spindle of the key takes into a spindle in the lock, which, by means of levers, operates the bolt of the lock, and on this spindle turns a tube, or "hollow centre," as it is termed, having a circular plate at the lower end, and on this another tube turns, which has in like manner a circular plate, and so on to any number required.

These plates and tubes are connected together with pins, so that the combination can be varied at pleasure; the outer one of these tubes and the scutcheon plate are graduated to form an index to the permutations. When the wheels are properly situated, relatively to each other and to the bolt, the lock can be opened or closed.

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3. For an improvement in *Carding Engines;* Horace Barbour and John Gleason, Lowell, Mass., December 4.

The patentees say—"We make a brush of fine wire, with straight teeth, about one inch long, thick set in leather, like the common card, covering a cylinder as long as the card to be stripped, and about five inches in diameter. Our invention consists in a combination of this brush with the cards of a carding engine, so as to strip the main cylinder, or other cards, while in motion, without stopping them, and without manual labor."

Claim.—"We do not claim attaching or fastening the top cards to the endless chain or belt, and taking them over rollers, or any part of Crane's self-stripping carding machine. What we claim is the combination of this brush with their revolving top cards, (so as to strip them as they pass along,) attached to the endless belt or chain, thereby dispensing with their sweeps, stripping and cleaning cards and cranks. And this combination we claim as an improvement upon their machine."

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4. For an improvement in the process of *Treating*, *Purifying*, and *Bleaching Oils* and fatty matters, and in making *Soap;* Arthur Dunn, Rotherhithe, Surrey county, Great Britain, December 4.

Claim.—"Having thus described the nature of my invention, and the best means I am acquainted with for performing the same, I would wish it to be understood that I do not claim the apparatus herein described, for forcing streams of air into and through oils and fatty matters—whether purifying, bleaching, or saponifying them—as any suitable apparatus may be employed for that purpose. But what I claim is—1st. The mode of heating, purifying, and bleaching oils and fatty matters, by causing streams of air to be forced, or pressed, into or through them, as herein described. And, 2dly, I claim the mode of manufacturing soap, by causing streams of air to be passed through and amongst oils and fatty matters, when combined or together, with suitable saponifying materials."

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5. For an improvement in the *Sofa Bedstead;* Gerard Sickles, assigned to Giles L. F. Griswold, Middletown, Ct., December 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of throwing out the front and back at the same time, by means of levers at or in the ends of the sofa, thereby changing from bedstead to sofa, and *vice versa*, at pleasure."

The front and back are connected together with levers placed in the ends of the sofa, which are hollow for that purpose.

6. For an improvement in the apparatus for *Evaporating Substances to be used in giving Vapor Baths;* Alford C. Haines, M. D., Plattsburgh, Burlington county, N. J., December 4.

Claim.—"What I claim is the mode herein described of constructing my vapor apparatus; that is to say, the water vessel or boiler having a top perforated with numerous small holes, and passing through it a copper coil, and combining with the same the vessel with a perforated bottom for holding the herbs for medicating the bath—the whole being constructed and operating substantially as described."

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7. For an improvement in the *Washing Machine;* Nathan Parish, Rush, Monroe county, N. Y., December 4.

In this machine the clothes to be washed are put in an endless cloth, and are acted upon by a roller, the whole being placed in a water-tight box.

Claim.—"What I claim as my own invention, and for which I ask an exclusive privilege, is the combination of the fluted roller and revolving endless apron, with the box, or water-tight case, for the purpose of washing clothes."

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8. For an improvement in *Cooking Stoves;* Adam Ketler, Philadelphia, Pa., December 7.

Claim.—"Having thus fully described the manner in which I construct my cooking stove, what I claim therein as new, and desire to secure by letters patent, is the particular combination and arrangement of parts by which the action and passage of heated air from the fire-chamber to the exit pipe are governed, as herein described—such combination and arrangement consisting in the dividing of the upper horizontal flue above the oven in two unequal parts, one part covering the large portion of the oven—in this part being furnished with a double plate, the direct passage from the fire-chamber being over it, and the other compartment being separated from the oven by a single plate, and admitting the heated air into it through a flue opening at its fore end, and along it to the exit pipe at its rear end; the whole combination being substantially the same with that herein set forth."

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9. For improvements in the *Machine for Filing Saws;* Calvin B. Rogers, Saybrook, Middlesex county, Ct., December 7.

In this machine there are two files, each attached to a sliding carriage, for the purpose of passing it over the saw, and they are connected with levers so arranged as to lift the files from the saw on the back movement, to permit the saw to be moved, and present the teeth in succession to their action. As the claim refers throughout to the drawings, we are under the necessity of omitting it; but it is limited to the combination and arrangement of the vibrating carriages,

the adjustable files, and the apparatus for lifting them, in order to liberate the saw teeth from their action, as the saw is shifted.

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10. For an improvement in the mode of preparing, applying, and using certain fluxes for the *Reduction of Ores* in the Blast Furnace; Jonas Towers, Madison, Lake county, Ohio, December 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of those earths or minerals which are dissoluble or diffusible with water, and have an adhesive nature, and can be made into a paste, pap, or grout, with the above or other liquids, and can be applied as other fluxes for the reduction of ores or minerals in the blast or other furnaces. I claim the application of the above preparation, as herein described, to other minerals as well as iron, which have a similar objectional tendency, while smelting, that is found with iron. I do not claim any special right to the use of the above fluxes in a dry or natural state; it is only after they have been mixed or diffused with water or other liquids, and formed into a paste, pap, or grout, and applied as a coating or adhering substance, as herein described, that I claim as my invention, or discovery, and desire to secure by letters patent."

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11. For an improvement in the manufacture of *Cassimere Hats*: John Maguire, Washington, D. C., December 7.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the making of hats of two distinct and seamless parts, viz: the body and the cover—the whole being manufactured in the manner and for the purpose herein above set forth."

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12. For an improvement in the *Machine for Cleaning Grain*; Thos. A. Chandler, Rockford, Ill., and Asa D. Reed, Niles, Mich., December 7.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the manner herein set forth of separating the grain from the straw and chaff by means of a screen constructed with parallel elastic wires fixed at one end, and free to move at their other ends, merely resting upon the frame of the screen—said screen vibrating up and down, by which means the elastic movement of the wires opens the straw, and thus gives full action to the blast."

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13. For an improvement in the *Furnaces of Steam Boilers, &c.*; Leman Bradley, Sharon, Litchfield county, Ct., December 12.

This consists in dividing the stack into two, three, or more compartments, by means of partitions extending from the top to a point a little above the entrance of the blast. Into one of these divisions the coal only is put, and the usual charge of ore, coal, &c., in the others; and that part of the hearth which is below the coal division is elevated above the other portion, that the coal may be kept up to the blast,

and permit the melted metal to descend below it. The patentee sums up the operations and the advantages in the following words, viz: "The greatest part of the charge being put in the compartment next to the head-stone, the metal will rest on the boshes, and will not come down faster than it is melted by the blast—the principal part of which comes in through the body of coal in the chamber, from the blow-pipe; the combustion being thereby rendered perfect before the blast reaches the metal, a great saving of fuel is effected, and a better quality of iron is produced. The damper over the coal chamber is kept down during the operation, and the gases are allowed to escape through the chambers on the opposite side of the partition. The fuel in the chamber rests on the hearth, and cannot fall much below the blast. A small blast can also be thrown in on the opposite side of the furnace to the main blast, which is regulated at pleasure."

Claim.—"Having thus fully described my invention, what I claim therein as new, and desire to secure by letters patent, is forcing the air into the fire-chamber in the manner described, above and below the fire, in combination with the method of discharging the products of combustion, as herein set forth, from the fire-chamber. I also claim, in combination with the above, the forcing the products of combustion through a reservoir of water, substantially in the manner and for the purpose above set forth."

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14. For an improvement in the *Apparatus for regulating the Draught of Chimnies;* Joseph Hurd, Stoneham, Middlesex county, Mass., December 12.

The patentee says: "My apparatus, although similar in its principle to the 'Barker's Reaction Mill,' and operating very much like it, is nevertheless applied to the top of a chimney for a different purpose from what the said mill is generally applied—the object of such apparatus being to keep up a steady and regular draught through the chimney, and at the same time prevent the wind from blowing the smoke down the flue."

Claim.—"I shall claim the employment upon a chimney, or discharge flue, in the manner described, of a long tube, having closed ends, and orifices through its opposite sides, at or near its ends, and otherwise arranged and operating as set forth, the same being for the purpose of regulating the draught and facilitating the escape of smoke, as explained."

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15. For an improvement in the *Centrifugal Reaction Water Wheel;* Samuel L. Valentine, Bangor, Penobscot county, Me., Dec. 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the water-wheel constructed as herein described, the buckets of which are on a line exactly parallel with the shaft in their cross section, and extend into the centre with flat rings around their periphery, and without any shrouding beyond the outer rings towards the centre—the whole being arranged so that the wheel can be made to run either way, in the manner and for the purposes herein set

forth, combined with the flume on each side thereof, as herein specified."

The reader may imagine this to be a reaction water wheel of the usual construction, with the buckets extended to the shaft, and without a plate on either side of the buckets, so that the water can be applied on both sides, the shaft being horizontal, and the flume so arranged as to conduct the water to both sides. The wheel is provided with rims at the outer extremity of the buckets.

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16. For an improvement in the *Abdominal Supporter;* Calvin Cutler, Springfield, Hampden county, Mass., December 16.

Claim.—"Having thus explained the nature and principles of my invention, it is not my intention to claim generally the use of lateral pads, as heretofore applied, but to claim one or more lateral pads as combined with or used in connexion with the central pad, and in front of the crest of the ilium, for the purpose of producing uniform pressure on the site of the colon and kidneys on the right side, from the capal coli, or head of the colon, to the lower rib of the same side, and upon the left side from the sigmoid flexure of the colon to the lower rib of the same side."

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17. For improvements in *Machinery for Cutting Leather into Soles for Shoes and Boots;* Richard Richards, Lynn, Essex county, Mass., December 16.

The claims in this case refer to, and are wholly dependent on, the drawings, the publication of which, from the numerous sections, would carry us beyond the limits of this work, and therefore we are under the necessity of omitting the claims.

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18. For an improvement in *Saw Mills;* Calvin Stigleman and Austin Seely, Madison county, Ill., December 16.

This saw is to be worked without the usual saw-gate for straining it, this being effected by the elastic force of steam. The two ends of the saw are connected each with a steam piston, the lower one being much larger than the upper one, and the two cylinders in which they work are connected together by a steam pipe, so that the pressure of steam acting on the two pistons strains the saw, and it is carried down to cut by reason of the greater capacity of the lower piston than the upper one.

Claim.—"What we claim as our invention, and desire letters patent for, is the adaptation and application of the upper cylinder in straining and running of saws without a frame, and for all other purposes for which it can be used to advantage, as represented in the drawing herewith transmitted."

19. For an improvement in *Splints for Fractured Limbs;* Lewis Post, Lodi, Seneca county, N. Y., December 16.

Instead of the splint box, or double inclined plane, hinged and provided with screws, as heretofore employed, the present patent is for making of the splints themselves, which are adapted to the form of the limb, the double inclined plane, by uniting with a hinge the extension, thigh, and leg splints.

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20. For an improvement in the *Cooking Stove;* Archibald Whiting, Middletown, Dauphin county, Pa., December 16.

We are under the necessity of omitting the claim in this case also, as it refers to, and is wholly dependent on, the drawings. It is limited to an arrangement of the flues and dampers for conducting the draught around the oven back of the fire chambers, and the one which extends under the fire chamber and the back oven.

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21. For an improvement in the *Cooking Stove;* Wm. L. Potter, Clifton Park, Saratoga county, N. Y., December 19.

Claim.—"What I claim as my invention is the mode of combining my two ovens and flues, viz: the draught descending at the back of both ovens, under the lower oven, and up in front of the lower oven in one entire sheet, and dividing at the front of the upper part of the lower oven, on either side of the stove, into two flues, the draught under the upper oven being directly from the lower part of the fire chamber through a contracted flue, in the manner and for the purpose described."

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22. For a *Machine for making Wooden Boxes for Match Splints, &c.;* John H. Stevens, New York city, N. Y., December 19.

These boxes are made by cutting out a square groove from a block of wood, by means of two circular saws on one shaft, placed at a distance apart equal to the width of the inside of the intended box, and the wood between them is cut away by rotating cutters, and then by two small circular saws, at right angles to the first; small grooves are cut near the upper edges to receive the cover. The ends are glued in afterwards.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the cutter and saws, by which the boxes are cut out with the cutters, for making the grooves to receive the lid as described."

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23. For a *Machine for Planing and Dressing the knuckles of Butt Hinges;* Gage Stickney, Blackwoodtown, Camden county, N. J., December 19.

The hinge, opened, is placed on the bed of the machine, with the projection of the knuckle which is to be planed, upwards. Two guide jaws are brought down upon it, one on each side of the knuckle, and kept down by weights, and the hinge is then forced forward against the tool which planes and dresses the knuckle to the form re-

quired—there being guide pieces beyond the cutter, to guide the hinge as it passes under the cutter.

Claim.—"Having thus fully described the nature of my improvements in the machine for planing or dressing the knuckles of butt hinges, and shown the operation of the same, I do hereby declare that I do not claim to be the inventor of either of the individual parts or devices herein described, when taken separately and alone; but what I do claim as constituting my invention, and desire to secure by letters patent, is the particular manner in which I have combined and arranged these parts so as to adapt them to the operation of planing or dressing, as set forth: that is to say, I claim the manner of forming and arranging the guide jaws, so as to press simultaneously on each side of the hinge to be planed, in combination with the follower, the bed, the planing tool, and the guide-pieces which govern the hinge as it is being planed—the whole combination and arrangement being substantially the same with that herein set forth."

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24. For an improvement in the *Plough;* Anthony Taylor, Greenford, Columbiana county, Ohio, December 19.

The point of the plough is covered by an additional point, made with a socket, to slip on to the usual point. And for the purpose of strengthening the land side, an additional land-bar is put on by bolts, the forward edge being made with a lip and sharp edge, to embrace the share.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the use of the shoe or socket point, made as aforesaid, in combination with the before-described plough. I do not claim an additional or false land bar, but the mode, herein described, of strengthening the share by means of the extra land bar, by which I am enabled in my plough to use wrought-iron shares."

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25. For an improvement in *Safety Switches for Railroads;* Gustavus A. Nicolls, Reading, Berks county, Pa., December 19.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is a safety turnout switch, embodying the combined use of inclined planes and guides to elevate and slide the wheels on the tracks, and the combination of these planes and guides with the safety bars."

This improvement, as indicated in the above claim, consists in the employment of two parallel bars attached to, and moving with, the switch; so that, when the switch has been shifted and put in connexion with the turn-out rails, they are in line with the rails of the main track: and, in the event of neglect on the part of the attendant to replace the switch, a car from the main track will run on to these parallel bars, which are, at their fixed end, connected with the main track by means of inclined planes and guides, so arranged as to elevate the flauch of the wheels (which are outside the track) over the rail, and guide the whole of them to the line of the track, and thus prevent the cars from running off.

26. For improvements in *Locomotive Steam Engines;* Edwin F. Johnson, Middletown, Middlesex county, Ct., December 31.

The improvements claimed, and for which letters patent are desired, are the following: 1st. The vibrating cross-head, and mode of attaching the two connecting rods thereto, so as to permit the drawing of driving wheels, to conform to the curvature of the road, without interfering with the movement of the steam-pistons. 2d. The mode of maintaining or preserving the relative motion of the two sets of drawing or driving wheels, by the combination of the horizontal slide rod, the arms, the crank bars, and the cranks, on the axles of said wheels. 3d. The mode of communicating the motion from the cross-heads to the crank bars, by attaching the connecting rods to the crank bars between the crank pins; also, the mode described and represented of retaining the frustums of cones in their proper position, by means of the vertical bars and horizontal bars. 4th. The mode of giving steadiness and support to the vibrating cross-heads, by combining with them the eccentric cog wheels and rods, as described, and the attaching of one pair of said wheels firmly to the same shaft. 5th. The use and application of the rods and lever, on the two sides of the machine, to conform the drawing or driving wheels to the curvature of the road.

It will be evident to the reader of the above claim, that, without drawings, it would require a very lengthy description to point out clearly the improvements covered by this patent; but the claim is sufficient to enable the engineer to understand the general plan of the inventor.

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27. For improvements in the *Machine for Hulling and Cleaning Clover Seed;* A. B. Crawford, Wooster, Wayne county, Ohio, December 31.

The rubber is composed of two truncated cones, united by their bases, so as to be of greater diameter in the middle than at the two ends. The grain is fed in at the two ends with a current of air, and discharged at the middle. The concave, of course, being of the same form.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the rubber and concave substantially in the manner set forth; the seed being received in at the two ends, and, together with a current of air, discharged at the centre. I also claim the combination of the screens with the sieve, in the shaking shoe, in the manner and for the purpose set forth, and, in combination therewith, the directing windboards, for the purpose above described."

The screens are made with slats, like a venetian blind, and the sieve is the usual clover sieve. Windboards are properly arranged to direct the current of air on to the grain.

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28. For an improved mode of feeding and turning the rod in *Nail Cutting Machines;* Caleb Isbister, Allegheny city, Allegheny county, Pa., December 31.

Claim.—"What I claim as my invention, and desire to secure by

letters patent, is the mode of feeding the nail rod, or plate, to the cutters, by means of a rotating hollow shaft, or tube, operating substantially in the manner described, whereby the rod, or plate, is turned over at each operation. I claim, also, the combination of the parts which communicate the progressive feeding motion to the nippers, by the up-and-down movement of the forward end of the rotating hollow shaft, or tube, as described; and I claim the combination of parts by which the nippers are brought back, and the machine stopped. And, finally, I claim the combination of parts by which the motion is communicated from the nail machine to the rotating hollow shaft or tube."

As all who are acquainted with this branch of manufactures know well, one end of the nail is thicker than the other, it becomes necessary to reverse or change the inclination of the rod at each time a nail is cut, to make the head end from opposite sides at each successive operation. By hand the former course is pursued, which prevents the action of the cutters from bending the rod; but by the machines heretofore employed or essayed for this purpose, the inclination only has been changed; and the object of the present improvement is to effect the presentation of the rod in the same manner as by hand, and thus prevent the tendency to bend the rod.

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29. For an improvement in *Propelling Ships;* John Ericsson, New York city, N. Y., December 31.

The propeller, with its hub, is hung to a swinging or sliding frame, by which it can be drawn out of the water, to remove all obstruction to the sailing of the vessel during fair winds; and the shaft is so arranged as to admit of sliding endwise, for the purpose of withdrawing it from, or introducing into, the hub. The rudder is placed abaft the propeller, and arranged with the view of avoiding all interference with this arrangement of the propeller.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the propeller shaft and rudder, in combination with the mode of attaching and detaching the propeller by means of a swinging or sliding frame, in the manner hereinbefore described."

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30. For an improvement in the *Machine for Planting Seeds;* Wells Kilburn, Lawrenceville, and Frederick Haines, Marietta, Pa., December 31.

In this machine the seed box has two grooves in the bottom, one towards the front, and the other towards the back, extending from side to side: and these communicate with a series of tubes that run down into holes in the cultivator teeth—the tubes of the front groove are between those of the back groove, and over each groove there is a square roller, to regulate the supply of seeds. The cultivator teeth which form the furrows, and through which the seeds are conducted, are hinged each to a beam jointed to the forward part of the frame,

and provided with a roller at the back end, to follow the undulation of the surface, and regulate the depth of the furrow. The cultivator teeth are also connected with the forward part of the frame, by means of chains attached to them below the joint, so that, in case of meeting any serious obstruction, the chains will break, and permit the teeth to pass over unharmed

Claim.—"Having thus fully described our invention and its operation, what we claim therein as new, and desire to secure by letters patent, is the combination of a series of cultivator teeth with the adjusting rollers and frame, as herein described—said teeth being jointed and adjustable, and the whole constructed and arranged substantially in the manner and for the purpose herein set forth."

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31. For an improvement in the *Horse Power;* Samuel B. Haines, Greensburgh, Westmoreland county, Pa., December 31.

The master wheel in this machine is without a shaft, and is therefore guided by rollers, and the horse levers are attached to flanches on the outer periphery, and to each other, forming a quadrangular frame. The band wheel, with its shaft, is placed within the driving wheel.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the band wheel within the master wheel, as described, in combination with the arrangement of the horse levers around and attached to the periphery of the main driving or master wheel—the whole being substantially as herein above described."

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32. For an improvement in *Machinery for cutting Screws on the Posts and Rails of Bedsteads;* Wm. F. Converse, Richard H. Penny, and Richard S. Hannaford, Harrison, Hamilton county, Ohio, December 31.

Claim.—"What we claim as our invention, is combining the sockets and cutters for cutting the screws on the rails and in the posts, with the mandrels of a lathe for turning wood, in the manner and for the purpose substantially as described. We also claim attaching the cutters for cutting the screws on the ends of the rails to a socket, which works on a screw or mandrel, so that the length of screw is cut beyond the socket, and thus the necessity of running the threads of the socket into the threads cut is avoided. And, finally, we claim attaching the cutter for cutting the threads in the post, on the outer periphery of a socket having a female screw working on a screw or mandrel, for the purpose fully set forth."

List of American Patents which issued in the month of December, 1841, *with Remarks and Exemplifications. By* CHARLES M. KELLER, *late Examiner of Patents in the U. S. Patent Office.*

(Continued from Page 27.)

12. For improvements in the *Cast-Iron Plough;* Reuben McMillen, Middlebury, Summit county, Ohio, December 14.

Claim.—"I do not claim to be the first who has cast the land side and beam in one piece, this having been previously done, but not in a manner similar to that devised by me. What I claim, therefore, in this part, is the so forming of the beam as to cause it, on its lower side, to rise directly from the forward and lower points of the mould board, and its upper edge to rise directly from the upper and forward end of the said mould board, its lower portion constituting a continuation of the land side, said beam rising thence upward and forward; and in combination therewith, I claim the casting of the share and coulter in one piece, in such a manner as that a V groove on the back edge of the coulter shall be received by a corresponding edge on the front line of the beam or land side, by which means the coulter will be retained in its place, and secured against the action of a blow on the under side of the point or share. I claim, likewise, the particular manner in which I confine the share in place, by means of what I denominate the saddle, and the hooked tenon, or tenons, and the dove-tailed tenon, adapted to the dove-tailed gain, or notch, in the land side, into which it is slipped back, the respective parts being constructed and operating substantially in the manner set forth. I also claim the particular manner in which I secure the mould board to the land side, by means of the hooked piece in combination with the mortise, the share, and the projecting piece on the inner part of the land side, for sustaining the point, or forward end, of the mould board, all as described."

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13. For an improvement in the *Machine for Cleaning Grain;* David Baldwin, Whithall, Washington county, N. Y., December 14.

The grain is acted upon by rotating beaters and segmental buckets, on a vertical shaft, the whole working within a casing. The radial beaters are placed between a series of rings, or "circular plates," which are connected with the shaft by spiral wings, which produce a current of air through the machine. The beaters do not extend inwards quite so far as the inner periphery of the rings, or circular plates, which are connected together by means of eccentric segment plates, which concentrate the current of air. The number of circular plates may be regulated by the judgment of the constructor: in the drawings, five are represented.

Claim.—"What I claim, is the employment of spiral wings for connecting the circular plates to the hubs and shaft, and compressing the air in the case, in combination with the segment buckets and radiating beaters, as herein set forth."

14. For an improvement in the mode of *Polishing Daguerreotype and other Plates;* John Johnson, New York city, N. Y., December 14.

This is for an apparatus with which to present plates to a polishing disk on the mandrel of a lathe, the character of which is fully expressed in the following claim: "What I claim, is the polishing of metallic plates for Daguerreotype or other purposes, by means of an instrument such as I have denominated a plate-holder, in combination with a wire or rod, received within a socket, upon which the said plate-holder and the contained plate may revolve, when held against a polishing disk or buff, and by which it may be shifted towards or from the centre of said buff, the whole apparatus being arranged, combined, and operating substantially as herein set forth."

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15. For an improvement in the mode of opening and closing *Waste Water Gates;* Robert Robinson, Greece, Monroe county, N. Y., December 14.

The gate (or gates) is provided with a chain which passes over a roller, and is attached to one end of a lever, the other end having a box suspended to it. When the water rises too high, it passes over a dam, and fills the box, which, by its preponderance, sinks, and opens the gate; and the box being provided with small holes, after the water has ceased to flow over the dam, it runs out of the box, and thus gives the preponderance to the gate, which is then closed by the pressure of the water.

Claim.—"What I claim as my invention, is the method of opening and closing the gates, by the combination of the gates and box attached to the lever, for the purpose described."

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16. For an improvement in the *Hydraulic Gate*, for Locks, Docks, &c.; Geo. Heath, Little Falls, Herkimer county, N. Y.—anti-dated July 3d, 1841.

This improvement consists in using for the gate, singly or in two parts, the segment of a cylinder for the front of the gate, with the radius which cuts the centre line of the arch of the segment lying horizontally, and with the arch next the water which is to be passed. This front of the gate rests for its support against the pressure of the water, on gudgeons at the centre of the cylinders, which are connected with the front, either by arms, or by the sector of a circle, at the two ends of the segment.

Claim.—"What I claim, is making the gates in segments of cylinders, hung upon gudgeons, as described, so that the pressure of the water against the gate shall be borne by gudgeons, instead of the edge of the slide, as in the common sliding gate."

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17. For an improvement in the *Furnace for the manufacture of Malleable Iron directly from the Ore;* Claude S. Quillard, Rondout, Ulster county, N. Y., December 23.

Claim.—"I claim the combining of one or more reverberatory fur-

naces with a chimney, or stack, containing in its lower part a deoxidizing furnace, which I have denominated a crucible, in such manner that the said crucible and the contained ore and carbonaceous matter shall be heated by the flame and escape-heat from the reverberatory furnace, or furnaces, by an arrangement and combination of respective parts, substantially the same with that herein made known. Secondly. I claim the manner of agglutinating the mass of deoxidized iron, previously heated in the reverberatory furnace, by submitting the same to pressure within a cylinder, or other formed receiver of any suitable construction, by means of a screw lever, or other press, preparatory to its being acted upon by the hammer, or by rollers. I am aware that puddle balls, or loops, have been squeezed, and worked, by means of a vibrating lever, upon a flat table; but this is an operation which could not be applied to the iron as prepared by me, as, instead of agglutinating, it would separate its particles—its pressure in a contained vessel being an essential part of my process."

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18. For an improvement in *Pneumatic Springs*, for Railroad Cars and other purposes; Alex. Connison, Belleville, Essex county, N. J., December 23.

The claim in this patent refers to the drawings, and we are, therefore, under the necessity of omitting it; but it is limited to the combination of a hollow piston rod, having an enlargement within the cylinder, which constitutes one of the piston heads, with the piston, the under face of which is a hemispherical cup, and hemispherical leathers fitting therein, and a bolt, the head of which fits into the leather cups, and passes up through the hollow piston rod, so that by a screw nut on the outer end, the cup-formed leather packing can be regulated at pleasure."

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19. For a mode of *Propelling a Locomotive by Stationary Machinery;* John A. Etzler, Philadelphia, Pa., December 23.

The claims in this, as in the preceding, we are under the necessity of omitting, because they refer to, and are dependent on, the drawings; but the first section is limited to the method of communicating motion to a locomotive carriage from stationary machinery, by combining a double crank on one shaft, and at right angles with two bands, or chains, extending from the cranks, passing around a horizontal wheel, and thence extending to the two ends of a lever, which is thus vibrated by the rotation of the cranks—the vibration of the lever sets in motion a set of hands that actuate ratchet wheels on the shaft of the driving wheels. The second claim is limited to an arrangement of parts for shifting the relative position of the lever, as the carriage progresses; and the third claim is limited to the arrangement of a lever attached to the back axletree for guiding the locomotive.

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20. For an improvement in the *Portable Counter Balance;* Albert Dole, Bangor, Penobscot county, Me., December 23.

Claim.—"I claim the combining a steel-yard beam and parallel

frame, arranged and supported as set forth, with the cradles constructed and operated as described, said cradle being provided with appropriate hods, and the whole being arranged and acting in the manner specified, so as to enable me, by the use of a single pea, to weigh pounds in the large hod, and ounces in the small one."

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21. For an improvement in the *Tobacco Press;* Joseph Bucey, Wes River, Ann Arundel county, Md., December 23d.

This is for an improvement in the Screw Press. The follower is permanently attached to the end of the screw, so that instead of turning the screw, it is carried up and down by turning the nut, and the improvement consists in connecting the nut with the cap-piece of the press, by means of a metallic box bolted to the cap-piece, and embracing the nut.

Claim.—"I claim the manner of forming and combining the nut and metallic box, as set forth, in conjunction with the combining them with the head block, or cap-piece, by means of which arrangement the press can be conveniently worked by horse power, whilst the head block of wood is left of such strength as to render it perfectly efficient."

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22. For an improvement in the *Wrought Iron Plough;* Marshal Mims and Seaborn J. Mims, Starkville, Oktibbeha county, Miss., December 23d.

The standard, or helve, of this plough, is attached to the beam by a single bolt at the top, and a diagonal brace, provided with several bolt holes, for the purpose of adjustment. The helve is also adapted to the reception of all kinds of mould boards, shovels, &c.

Claim.—"We claim the particular manner in which we have arranged and combined the helve brace and mould board, so as to adjust the position of the latter by means of the adjustable brace and the bolt, and thus to determine the depth of the furrow, in the manner described, whether applied to a single or a double plough, as set forth. We also claim the adapting to the same plough any of the various kinds of hoes, shovels, or other instruments, analogous in character, and occasionally used in the place of mould boards; such adaptation being effected by means of the adjustable brace and helve herein described."

ENGLISH PATENTS.

Specification of a Patent granted to James Fenton, *of Manchester, Engineer, for his invention of an improved combination or alloy, or improved combinations or alloys, of metals, applicable to various purposes for which brass and copper are usually employed, in the construction of machinery.*

This invention of an improved combination or alloy of metals is

intended to be used in the construction of machinery in general, in those places and situations where brass and copper are usually employed. The improved alloy, it is stated, may be beneficially used as a substitute for the ordinary metals, in consequence of its not being liable to heat, or subject to other destructive results, caused by friction and ordinary wear and tear; also, by greatly decreasing the consumption of oil or grease, and being of increased durability, and much lighter weight in the same bulk of metal. All these advantages will be sufficiently evident to the practical engineer and mechanic, as well as the great variety of purposes for which this improved combination or alloy of metals may be employed in the construction of machinery, such as steps, bearings, pedestals, journals, bushes, axle-boxes, connecting-rod ends, cocks, taps, pump-barrels, pump-rams, plungers for buckets, &c., and also as a substitute for the more elementary parts of machinery, (formerly made of brass and copper,) such as rollers, for calico and other printers, bowls, &c.

The manner of carrying this invention into practical effect, is to be according to the following formula:—Firstly, take thirty-two parts of copper, fifteen parts of block tin, and one part of sheet brass, and mix or combine these in the following manner:—The copper being fused, or melted, in a crucible, or other suitable vessel or furnace, the sheet brass is added thereto, and afterwards the block tin is thrown in; the alloy is then poured off in ingots, and a metal is produced, which the patentee terms "hardening metal." Under this head he claims the novel and peculiar use of these metals, to form "hardening metal;" but the quantities may be varied, to give the alloy any required degree of hardness, or various other metals may be added, in small quantities, to effect the same purpose; he likewise claims the use of these, in connexion with copper and block tin; the above constitutes the first part of the process employed by the patentee in the manufacture of his ultimate alloy or alloys.

Secondly, take two parts of the hardening metal, previously described, nineteen parts of zinc or spelter, (or so many parts of calamine as shall be equal to the quantity of zinc or spelter,) and three parts of block tin, and mix or combine these in the following manner: First, fuse or melt the zinc, spelter, or calamine in a crucible, or other suitable vessel or furnace, which must be sufficiently large to contain, along with the zinc or spelter, the hardening metal previously described, and the block tin last specified. The hardening metal should be fused or melted in a separate crucible, or other suitable vessel or furnace, and then mixed or combined with the zinc, spelter, or calamine; the alloy must be well stirred, with a suitable implement, in order to render the combination of these two metals or semi-metals as complete as possible. The block tin is then added, to give the ultimate alloy or alloys the requisite degree of ductility, or toughness. The whole must be again well stirred with a suitable implement, in order to render the combination of this, the ultimate alloy or alloys, as complete as possible. It may then be cast, or employed in the usual manner, in the various forms required for the construction of machinery. While the zinc or spelter is being melted, the surface of

it should be well covered with a coating of powdered charcoal, in order to prevent the volatilisation of the semi-metal. Under this head the patentee claims:—"The use of these metals and semi-metals, above described, to form my ultimate alloy or alloys; but the proportions may be varied, to suit particular cases, and a variety of other metals may be added in small quantities, the use of which I also claim, though not absolutely requisite to form my ultimate alloy or alloys. I further claim the use of the semi-metal zinc, spelter, or calamine, as the basis of my ultimate alloy; and although I have found the manner of combination above described the most effective in preparing the alloy or alloys which I substitute for brass and copper, in the construction of machinery, I claim the use of the said alloy or alloys, although combined in any other manner or proportions whatever; such combination or alloy being made, either in the exact proportions herein set forth, or in any other, within such limits as are substantially the same, and will produce a like result, as a substitute for brass and copper, to be used in the construction of machinery."

London Min. Jour.

Specification of a Patent granted to Robert Ferguson *and* John Clark, *both of the city of Glasgow, in the county of Lanark, for an improvement in Printing and Calendering.*—[Sealed 14th September, 1844.]

The first part of this invention relates to the cylinders or bowls of calico printing machines, and consists in forming the outer covering or surface of the cylinder in a peculiar manner, whereby the ordinary covering of "lapping" is dispensed with, and the employment of an endless blanket is rendered unnecessary, as the new surface is sufficiently smooth and elastic for obtaining the impression from the printing roller or rollers, whether engraved or cut in relief.

The improved covering or surface is formed in the following manner:—The cylinder, after being well cleaned, is rubbed over with a solution of green senegal, (formed by dissolving eight pounds of the gum in one gallon of water,) and placed in the printing machine, which is to be furnished with a plain copper roller, in place of the ordinary engraved printing roller; a piece of cotton cloth, coated on one side with India-rubber cement, is now placed with its uncoated side next the cylinder, and with a blanket interposed between it and the copper roller; a slight pressure being then put on the machine, one round of the cloth is rolled upon the cylinder, and is carefully cut from the remainder of the piece, so as to make a neat join. The patentees then take a piece of "Clark's patent India-rubber cloth," or a piece of cotton cloth, *mousseline-de-laine*, thin flannel, or fine woollen cloth, coated on one or both sides with India-rubber cement, or "Jeffery's patent marine glue," and, after cutting the end straight, it is laid upon the cylinder; a slight pressure is then put on the machine, (the blanket having been removed,) and from twenty to thirty rounds of cloth are rolled upon the cylinder: the end of each round

is cut correctly opposite the previous end, so as to make a good join. The pressure is increased every five rounds, ending with a pressure similar to that used in printing; and the machine is caused to continue in motion, with this pressure, for half an hour: the attendant keeping the copper roller clean, by rubbing it with a cloth, damped with weak soap-suds, to prevent the India-rubber cement, or marine glue, from adhering to the roller. After this, the outer surface of the cloth is coated with a mixture of India-rubber cement and lamp-black, to the thickness of one-sixteenth of an inch; or the mixture is applied to a piece of "Clark's patent India-rubber cloth," and one round of the cloth is rolled on the cylinder. When the mixture is dry, the elastic surface is cut to the required width, whilst the cylinder is revolving, by means of a chisel upon a rest; and the revolution of the cylinder, in contact with the copper roller, is continued for about an hour. The coating is now "cured," by rubbing over it sulphuric acid, of the usual strength, or muriatic acid, diluted with water to 60° of the Tweeddale hydrometer; this acid is allowed to remain on for about fifteen minutes, (the cylinder continuing to revolve,) and is then washed off with clean water. When in use, the cylinder is kept clean by a roller, covered with sponge or cloth, in a moist state; and the superfluous moisture left by the roller is taken up by a lint or dry doctor.

The following is another mode of producing the elastic surface: After the cylinder has been rubbed over with a solution of gum senegal, as before mentioned, and has received one round of cotton cloth or other material, coated on the outer side with India-rubber cement, a band or fillet of flannel, or other suitable material, (three inches in breadth, and coated on both sides, and at the edges, with India-rubber cement,) is rolled tightly round the cylinder, by commencing at one end and using a plain copper roller, which presses against it, until the band reaches the other end of the cylinder. This wrapping is then coated with a mixture of India-rubber cement and lamp-black, and when dry, the elastic surface is cut at the sides, and cured, as before described.

Another method consists in covering the cylinder with a few rounds of lapping, in the ordinary way, and applying thereto a quantity of Jeffery's marine glue, brought to a liquid state by the application of a heat of from 200° to 300° Fahr.: the cylinder is now ready for use.

A smooth elastic surface is also obtained by "putting together from twenty to thirty plies of Clark's patent water-proof cloth, or other laminæ, coated with India-rubber cement, or Jeffery's patent marine glue, in the manner before described," and making an endless strap or belt thereof, which is caused to embrace the cylinder, and a flanged roller above it, and is moved onward by the rotation of the same.

The second part of this invention consists in applying a smooth and elastic surface, in the manner above described, to the tables of block-printing machines.

The third part consists in producing smooth and elastic surfaces, in the same way, upon the cylinders or rollers of letter-press printing

machines; also in bringing Jeffery's marine glue to a liquid state, by the aid of heat, and casting it into rollers, to be used in letter-press printing.

The last part of the invention consists in the application of a smooth and elastic surface, by the methods above described, to the rollers of calendering machines.

The patentees claim, Firstly,—the application to cylinders, bowls, or rollers, for printing calicoes, of a smooth and elastic surface, in manner herein described; including the belt or strap traveling round the cylinder. Secondly,—the application of an elastic bed or surface for block printing, as above described. Thirdly,—the application of a smooth and elastic surface to rollers and cylinders, and the casting from Jeffrey's marine glue of rollers and cylinders for letter-press printing, as above described. Fourthly,—the application of a smooth and elastic surface to rollers or bowls for calendering, as above described.—[*Inrolled February*, 1845.] Trans. Soc. Arts.

MECHANICS, PHYSICS, AND CHEMISTRY.

The Progress and Present State of the Daguerreotype Art. By M. Claudet.

Continued from page 51.

Nevertheless, the invention of Mr. Woolcott was at the time a great improvement, and deserves to be recorded in the history of the daguerreotype as a very clever and very ingenious arrangement. The effect of the daguerreotype picture is formed by a very slight film similar to the bloom of the grape or the down of the wing of the butterfly, so delicate that it may be wiped off or destroyed by the slightest touch. This fragility induced may persons to endeavor to discover some method of fixing the design. Mr. Dumas, the celebrated chemist, discovered a vegetable varnish which, dissolved in boiling water, could easily be applied to the surface of the picture, and, when dried, was a perfect protection to the image. But it was left to Mr. Fizeau to discover what has proved one of the greatest improvements in the daguerreotype process, and which consists in fixing the delicate image by means of a transparent coating of gold, applied by boiling upon the plate a solution of chloride of gold, which not only renders the image more durable, but has the advantage of increasing the tint, so that a picture fixed by Mr. Fizeau's process is rendered more forcible, and the mirror-like effect is almost destroyed. Some time after Mr. Fizeau had made his discovery, I was fortunate enough to devise a means of increasing the sensitiveness of the prepared tablets. This I accomplished by exposing it, previously coated with iodine, to the vapor of a compound of chlorine and iodine, or chlorine and bromine, which second exposure so modified the chemical coating of the plate, that its sensitiveness was increased to at least fifty or sixty times, and from that moment it became possible to take portraits without difficulty with the ordinary apparatus.

With iodine alone, and a camera furnished with an achromatic object-glass of the shortest focus, it required about five minutes, though, by the simple addition of the vapor of chloride of iodine, I at once obtained the power of operating in as many seconds, and under the most favorable circumstances, in much shorter time; for it has been found possible to reproduce moving objects. In one word, the operation has (by the introduction of this improvement) been literally instantaneous.

Daguerre recommended that the plate should be exposed to the mercury at an angle of forty-five degrees, supposing that the vapor received upon it at that inclination would cause the development of the picture with greater effect. But this operation is equally effective and rapid in any other position, and I have not only succeeded in producing the image in a vertical or horizontal position, but, even when the coppered side of the plate was turned downwards or towards the mercury, I have found the effect to be precisely the same in all these various positions.

I have also ascertained that the mercurial vapor does not enter into combination with the surface of the plate, unless it has previously been exposed to the influence of light. A plate was exposed to the mercury before and after it had been coated with iodine, but the operation in the camera was not affected by this premature exposition of the mercury, so that it is absolutely necessary that the mysterious influence of the light should be exerted upon the plate before any degree of affinity exists between it and the vapor of mercury with which it is brought in contact.

The knowledge of this fact led me to a curious modification of the process of Daguerre.

Having ascertained that the mercury did not injure the sensitiveness of the plate, (before exposure to the light,) it occurred to me that it would be possible to conduct simultaneously the operations of the camera and the mercury-box, which I did by placing in the camera a cup containing mercury previously heated by a spirit-lamp. The plate was thus constantly immersed in the mercurial vapor during the exposure to the image of the camera.

As soon as the light had begun to operate, the vapor of mercury was combining with the iodine of silver, and, by means of a light striking through a piece of yellow glass, I was able to study the progress of the operation. For it is a curious fact, as I shall endeavor to shew presently, that yellow, green, and red rays of light scarcely produced any effect upon the prepared plate of the daguerreotype; and it is still more extraordinary that yellow light operates upon the plate in a manner perfectly analogous to that of mercury in the development of the invisibly impressed image, so that the light admitted into the camera obscura, so far from injuring the operation, was accelerating the development of the image. This effect of the yellow rays was first noticed by Mr. Bequerel, and, from this property, he has called them "continuating rays." Some photogenic paper had been exposed to light in a camera, and was afterwards submitted to the action of yellow rays by being covered with a piece of glass

of that color, and the image was soon made apparent by the specific action of the above-mentioned rays. Some time after, Mr. Gaudin repeated the same experiment upon a daguerreotype plate, and he also succeeded in producing the image by yellow light without any exposure to the action of the mercury. The effect produced by these two processes are so analogous, that it would be difficult, perhaps impossible, to decide which had been produced by mercury and which by yellow light. If the yellow rays perform in the development of the image the same action as the vapor of mercury, how are we to account for the effect? Yellow rays produce upon the plate those white microscopic dots or crystals which were assigned to the combination of mercury; but it is supposed that yellow rays cannot form a compound, that they can only modify the arrangements of the molecules of the surface and produce a sort of crystalization. And why should not mercury, by some electrical property, occasion a similar modification of crystalization without itself combining chemically with the plate. Already Dr. Moser, in his beautiful researches, has offered a theory upon the formation of the image by the vapors of mercury, in stating that these vapors develope latent yellow light, and that it is only as continuating yellow rays that the mercury brings out the image.

But it is more probable that the whole effect of the daguerreotype image is due to some electrical influence of light, and that mercury and yellow rays produce a like state of electricity.

Daguerre also recommended that we should raise the vapors of mercury by means of a spirit lamp, which heated the metal to a temperature of 165°, from which it was to cool gradually to 120°. But I have found that the temperature is quite immaterial, provided it is not raised to a degree which would cause sublimation. It has been ascertained that mercury evaporates at all temperatures above its freezing point, and those vapors are at all times sufficient to bring out the daguerreotype image. The only difference is the length of time required for the operation, this depending of course upon greater or less development of vapors. I have found that during the month of December, at a temperature of 45°, the image was brought out in two hours without heating the mercury, and I have been able, at the same temperature, to cause the development of the image in ten minutes, by placing the plate in the vacuum of an air-pump containing a small quantity of mercury.

I consider that the daguerreotype image is begun and finished by some electrical influence of light, that all the colored rays, as we have before mentioned, carry with them invisible rays which operate upon the plate, that the largest quantity of these accompany the blue rays, a lesser quantity the yellow, and a still less quantity the red. Thus the yellow ray is not entirely destitute of chemical power, although it operates very slightly upon the parts which have received the strong effect from the rays accompanying the blue, and, though enough to continue the effect begun, it is not enough to bite upon the parts not already effected. So that the operation begun by the in-

visible rays through the blue medium is completed by the small quantity of chemical rays accompanying the yellow light.

Without being able to decide which of the various kinds of rays emanating from the sun are those producing the photogenic effect, it is a well-known fact that they travel with all the rays of the spectrum, but that by far the largest proportion have a degree of refrangibility nearly agreeing with that of the blue rays, that the portion found with the yellow is considerably less, and still smaller with the red. In interposing a blue glass between the object and the image, the effect is nearly as great as if there was no medium; by the interposition of yellow glass the effect is considerably reduced, and almost totally impeded by red glass.

The great number of elements acting in the daguerreotype process, the ignorance in which we are concerning all their properties, the influence of various unknown causes, which undoubtedly perform a part in the operation, render the process very difficult and uncertain. So many conditions are requisite to a successful operation, that, indeed, it might be said that failure is the rule, and success the exception. This renders the task most delicate and arduous. The operator has constantly to overcome new difficulties, and the greatest is, perhaps, the want of power to appreciate the amount of operating rays existing at every moment. No photometer can be constructed; for the acting rays are not always in the same ratio to the intensity of light. It is true that, if it were possible to measure the comparative quantity of blue, yellow, and red lights, at all times, then it would be of considerable assistance in judging of the amount of photogenic light. But even this test would not be sufficient, for the acting rays are not strictly identical with the blue rays. Still, to be able to ascertain that there were no yellow or red vapors in the atmosphere, making, as it were, screens of those colors between the sun and the object, would be, no doubt, an important assistance.

It is to the influence of these vapors that the difference found by operators in various climates is due, which difference seemed at first irrational, but which can now easily be explained.

When the daguerreotype was first discovered, it was expected that southern climates would be more favorable than northern for the process, and that, in countries, where the sun constantly shines, the operation would be considerably shorter. This has not been proved to be the fact, and the following reason may be given for such an apparent anomaly. Light is more intense in the northern latitudes up to a certain degree, on account of its being reflected in all directions by the clouds disseminated in the atmosphere; whilst in the drier climates the open sky, instead of reflecting light, absorbs a great quantity of it. Of course, in speaking of clouds, it cannot be meant that a completely covered sky is more favorable than a sky without any clouds, for in this case the sun is entirely obscured. But still there are days when, although the disk of the sun is not seen from any part of the horizon, the thin clouds allow a much more considerable quantity of photogenic rays to be diffused and retained in the lower strata of the atmosphere than when there are no clouds, and

that by some imperceptible vapors the light has a yellow or red tint.

There is a curious fact which would seem to corroborate the argument in favor of greater intensity of light in northern climates. It is known that, by a provision of nature, all races of men are constitutionally adapted to the climates in which they are destined to live, that the inhabitants of the tropics can bear a much higher temperature than the inhabitants of the north. May it not be the same for light? The eyes of the inhabitants of the cloudy and snowy countries are adapted to bear a stronger light than those living in the south. In the course of my daguerreotype experience, I have observed that there is a comparatively greater number of Englishmen, than of Frenchmen, Spaniards, and Italians, capable of sitting for their portraits in a strong light, without being much incommoded. If this fact is correct, such a provision of nature would prove that generally light is more intense in the northern climates, and that it decreases gradually towards the equator.

It was at first expected that the climate of England, and countries similarly situated, would be unsuitable to the daguerreotype operation; nevertheless, it has turned out that this is one of the most favorable climates for the practice of the process. Putting out of the question the greatest part of the months of November and December, when the fog mixed with the smoke obstructs all light in London, I assert, from my own experience, that the climate of this metropolis is generally more propitious than that of Paris to photographic operations, for the representation of near objects, and for taking portraits. Of course, this observation does not apply to general views taken at a distance; for, in this case, although the light is photogenic, still the misty vapors which generally prevail in England are an obstacle to the formation of clear images. In such a case, the sensitive surface has quickly and fully been affected, but not in a clear and defined manner.

There is another curious fact connected with the photogenic operation, which is, that on the summits of high mountains the action of light upon the plate is not so intense as in the lower regions. A clever operator was sent two years ago from Paris into Italy to take daguerreotype views of the most interesting spots of that country. After having visited Rome, Florence, Naples, Venice, and other towns, and succeeded in producing a beautiful and curious collection, he wished, in crossing the Alps on his journey home, to obtain some views of the glaciers, and other Alpine scenes; but what was his surprise in finding that he could not obtain in one hour, and one hour and a half, in full sunshine, an image of these snowy mountains, having the same degree of force and distinctness as views which he had produced in less than fifteen minutes in the lower countries which he had just visited. The skill of this operator was great; he tried several times, and always with the same difficulty, and at length he abandoned the idea of bringing with him a perfect specimen.

The cause of this fact may be ascribed to the reason given before, that a sky without clouds absorbs a great quantity of light, and that

upon high mountains the rarity of the atmosphere would occasion a certain loss of light. But it remains to be ascertained to what degree the light is absorbed, or otherwise affected by the variation in the density of the air at great elevation above the surface of the earth.

Before concluding, I must speak of a very important improvement lately applied to the daguerreotype art, which has not as yet been published. I allude to a new process by which the daguerreotype plate may be engraved by a chemical operation, and formed into a metallic plate, from which may be printed an unlimited number of copies.

Since the discovery of the daguerreotype, the attention of many ingenious persons has been turned to this interesting subject; Mr. Donné, in Paris, Dr. Berrès, at Vienna, and Professor Grove, in England, have all separately made several attempts. The first two gentlemen have not published an account of their processes; but they have produced specimens which shew that engraving by the daguerreotype is not altogether a desperate case.

The process of Professor Grove consists in dissolving by the electrotype process the parts of the picture which consist of pure silver: thus the plate is etched in, and transformed into an engraved plate for printing. This process is very ingenious, and creditable to the inventor; but it appears that the action of the galvanic battery sometimes extends to those parts which should remain unattached.

Mr. Fizeau, to whom the daguerreotype is already indebted for one of its greatest improvements, viz: the fixing of the image, is the fortunate discoverer of this new mode of engraving by a chemical operation.

By his process an unlimited number of copies may be obtained without impairing the plate. This discovery seems to complete the art, and to render it really useful.

Now, sculpture, painting, architecture, models from life,—all the productions of the fine arts,—portraits, &c., will be reproduced in their reality, while works of literature and science will be illustrated, not by wood-cuts, not by artistic engraved steel or copper-plates, but by the exact copies of the daguerreotype image.

Although the daguerreotype has hardly been in existence four years, it already ranks as one of the most prominent inventions of the present day, leaving scarcely any thing to look for in the way of improvement. It is true that it remains to find the means of reproducing the natural colors of objects; but, although there seems no dream too marvellous in the progress of discovery, still the idea of fixing the colors of the object in the camera obscura is so little in accordance with the present state of science and with the properties of the known elements, that we must be satisfied with the process as it is.

Trans. Soc. Arts, Mec. and Com.

On some commercial Specimens of Green Glass. By Robert Warington, Esq.*

Some short time since some green glass wine bottles were put into my hands for examination, the inner surface of which was covered with a thin film, having a dull and slightly opaque appearance. The question to be solved was, the possibility of removing this so as to restore the glass to its original transparency. My first impression, from the general appearance of the bottles, was that this dullness was to be attributed to some matter mechanically adherent to the surface, and that it probably arose from their having been washed with foul, greasy, or soapy water; but on examination this was found not to be the case, the surface of the glass having been evidently affected by the action of some corroding agent. Portions of the glass were therefore submitted to the action of a weak solution of tartaric acid, as the acid most likely to be present in wines; and in the course of twenty-four hours, the vessel, in which the digestion was conducted, was one-fourth part of beautiful crystals of bitartrate of lime. It was also strongly acted upon by diluted hydrocholoric acid, forming a solution of chloride of calcium, and a gelatinous mass from the hydration of the silicic acid. From these preliminary experiments it was evident that a great excess of lime had been employed in the manufacture of the glass, and this had rendered it totally unfit for any of the ordinary purposes to which such bottles are applied. The glass was then submitted to analysis, and the routine followed, in this and the subsequent case, was similar to that adopted in the examination of all such compounds, I shall not detain the Society by going through the detail; suffice it to say, that the alkalies, soda and potash were separated by the fluoric acid process, and the potash estimated from the weighed quantity of the mixed sulphates thus obtained, by means of the double chloride of platinum and potassium.

The results, calculated to the 100 parts, are as follows:

Silica,	49.00
Lime,	24.75
Soda,	7.25
Potash,	2.00
Oxide of iron,	10.10
Alumina,	4.10
Magnesia,	2.00
Oxides of copper and manganese,	a trace
	99.20

On making additional inquiries concerning these bottles, I found that they were offered to the consumer, the wine-merchant, at a lower price than the ordinary wine bottles, and that the venders urged strongly the superiority of their goods under the recommendation that they caused port wine to deposit its crust much sooner and firm-

* Read before the Chemical Society of London, December 16th, 1844.

er, that is, adhering more tightly to the bottle, than would be the case where the common glass was employed. One gentleman had been a loser to a considerable amount from bottling a large quantity of white wine in these vessels, the bottles having become clouded, and the flavor of the wine, as a matter of consequence, being materially affected. As it was a question of scientific interest to ascertain to what extent the foregoing glass differed from our ordinary green glass of commerce, as occurring in the form of wine bottles, an analysis of this was undertaken, and the following are the results, calculated as before to the 100 parts:—

Silica,	59.00
Lime,	19.90
Soda,	10.00
Potash,	1.70
Oxide of iron,	7.00
Alumina,	1.20
Magnesia,	0.50
Oxide of manganese,	a trace
	99.30

On comparing these results with the former, it will be seen that the total amount of bases present is far less, and calculating them out as silicates, the first analysis will show a deficiency of silicic acid amounting to about 20 parts on the 100.

It was about the period of this examination being terminated, that Professor Faraday, in a lecture at the Royal Institution on the manufacture of glass mirrors, exhibited a French glass bottle which had been subjected accidentally by Mr. Pepys, Jun., to the action of diluted sulphuric acid, in the proportions of one of acid to ten of water; in a short time this had, by its action on the glass, produced a most extraordinary and beautiful crystalization of sulphate of lime in small, detached, and rounded pyramidal masses, tightly adherent to the surface of the bottle. In consequence of this curious action, I was induced to submit the bottles under notice to a similar mixture, and after having been filled and loosely corked they were put aside in a place of safety. In the course of two or three weeks I was surprised one morning to find the floor of the laboratory covered with wet, which had apparently run from the direction where these bottles had been deposited, and on examination they were found to be cracked in all directions, the fissures being covered with a deposit of gelatinous silica: on breaking one of these, the whole internal surface was found lined, for the thickness of about one-fourth of an inch, with a mixture of sulphate of lime and silica, the crystalization of which had evidently caused the fracture of the bottles; in some places the glass was corroded completely through its substance.

Lond., Edinb., and Dubl. Philos. Mag.

On the Conversion of the Essential Oil of Mustard into the Essential Oil of Garlic. *By* CHARLES GERHARDT.

The artificial production of substances which are generated in the process of vegetation or in the animal œconomy becomes more and more frequent as organic chemistry advances. I shall now draw attention to one which seems to me to merit attention.

The essential oil to which garlic owes its characteristic odor has been recently analysed by M. Wertheim, and according to this chemist contains $C^6 H^5 S$. It is therefore a sulphuretted body like the essential oil of black mustard, but free from nitrogen.

From the analysis of M. Lœwig, and from the researches recently made by Dr. Will, we know that the essential oil of black mustard does not contain oxygen, and that its true formula is $C^8 H^5 NS^2$. The result of M. Simon's observations also appears to be, that the essential oil of the Scurvy grass (*Cochlearia*) is identical with that of mustard; moreover, M. Mubatka has proved that the horse-radish yields the same essential oil; and M. Wertheim has also met with it in the oil obtained by distilling the root of another cruciform plant, *Alliaria officinalis*, with water.

Considering these facts, and comparing the composition of the essential oil of garlic with that of mustard, I have been induced to try to convert one into the other by the means which science affords.

The oil of garlic only differs from that of mustard by the elements of cyanogen and of sulphur; we have, in fact,

$$C^8 H^5 NS^2 = C^6 H^5 S + C^2 N + S.$$

In acting with potassium on the oil of mustard, I had to take away the cyanogen as well as a part of the sulphur, and to set free the oil of garlic.

My suspicions were entirely realized: when some pieces of potassium, previously dried over some chloride of calcium and rectified afresh, are thrown into the oil of mustard, it is attacked immediately. It may be slightly heated in a retort to favor the reaction; care must be taken, however, not to raise the temperature too much, for the substance might take fire, as has frequently happened to me.

If the operation is performed with care, the substance does not become much colored, some gas is disengaged, a white salt is deposited in the oil, and oil of garlic distils over. It is an interesting experiment, the difference of smell between the two oils being so striking: the smell of the garlic is immediately so evident, that this alone might suffice to prove that the conversion takes place as I have just described it.

But I desired to have chemical proofs. I therefore collected the oil which had been produced in the reaction; it was colorless, possessing in a high degree the characteristic odor of garlic, and presented the reactions described by M. Wertheim; shaken with a solution of nitrate of silver, it afforded a black precipitate of sulphuret; with the bichloride of mercury (when the aqueous solution was

slightly heated to dissolve more oil) it yielded a white, and with the bichloride of platinum a yellow, precipitate.

Burnt with oxide of copper, it yielded the same relative quantities of carbon and hydrogen as were obtained by M. Wertheim in the analysis of the oil extracted directly from garlic, and rectified without potassium, viz:

	My produce.	Rectified Oil of Garlic Wertheim.	Oil of Mustard.
Carbon,	58.8	59.1	48.5
Hydrogen,	8.4	8.2	5.1

I have not been able to make more analyses, from want of material.

The salt which separates in this reaction is *sulphocyanide of potassium;* in fact it dissolves easily in water, and gives with the persalts of iron the characteristic dark red color; it also yields a white precipitate, (protosulpho-cyanide of copper,) with a mixture of deutosulphate of copper and of protosulphate of iron, &c. I was unable to discover sulphuret or cyanide.

However, in rectifying the artificial oil of garlic a second time over potassium, I found much sulphuret in the residue. This reaction appears secondary. Besides, to understand the reaction well, it will be necessary again to examine the gas which is evolved, which want of material prevented me from doing.

The above results seem to be sufficiently conclusive to prove that the oil of mustard is really converted into the oil of garlic by the action of metallic potassium. I intend, however, to return soon to this metamorphosis.

Comptes Rendus, March 24, 1845.

Gutta Percha.

The secretary described this substance to be the juice of a large indigenous forest tree in Singapore; and is obtained by cutting notches through the bark, when it exudes in the form of a milky juice which soon curdles. In its chemical properties it somewhat resembles Caoutchouc, but is much less elastic; it however possesses qualities, which that substance does not, which will render it of considerable value as a substitute for medical instruments in hot climates. The Gutta Percha, when dipped in water nearly at the boiling point, can readily be united, and becomes quite plastic, so as to be formed (before it cools below 130° to 140° Fahrenheit) into any required shape, and which it retains at any temperature below 110°; in this state it is very rigid and tough, and is used in Singapore for chopper handles, &c., in preference to buffalo horn, and does not appear to undergo any change in the hot damp climate of the Straits of Malacca. The secretary produced casts from medals, a rough lathe band, a short pipe, &c., which he had formed for the occasion, a soda-water bottle, containing the juice as collected from the tree, had been entirely inclosed by a covering of the Gutta Percha, which was as tough as leather, but by immersion in hot water for two or three minutes was removed, and formed again into a solid lump.—*Proc. Soc. Arts.*

Athenæum.

Colorless Ink.

Sir George Mackenzie has invented a substitute, in a colorless fluid, for black ink, "the nastiness of which," he says, "has been submitted to for ages." A history of the invention was lately read by him to the Royal Society of Edinburgh. A properly prepared paper, however, is required; and the ink becomes blue or black, according to the sort used. We have tried the ink on the prepared paper, and found it excellent—on unprepared paper it remained colorless. Neither will it, like common ink, stain the fingers, or anything else, except silver, and then may be easily removed. It is obvious that its cleanliness is the chief advantage of the invention, which will commend itself accordingly to the drawing-room, boudoir and library.

Ibid.

On the Epipolic Dispersion of Light.

A paper was read by Sir J. W. Herschel, Bart., entitled, "On the Epipolic Dispersion of Light;" being a supplement to his paper, "On a Case of Superficial Color presented by a Homogeneous Liquid intimately Colorless." The author inquires whether the peculiar colored dispersion of white light intromitted into a solution of sulphate of quinine is the result of an analysis of the incident light into two distinct species, or merely of a simple subdivision, analogous to that which takes place in partial reflection, as exemplified in the colors of thin plates. He endeavors to ascertain the laws which regulate this singular mode of dispersion, which, for brevity, he terms *epipolic*, on account of the proximity of the seat of dispersion to the intromitting surface of the fluid. It might have been expected, that by passing the same incident beam successively through many such dispersive surfaces, the whole of the blue rays would at length be separated from it, and an orange or red residual beam be left; but the author establishes by numerous experiments the general fact, that an *epipolical beam of light*, meaning thereby a beam that has been once transmitted through a quiniferous solution, and undergone its dispersing action, is incapable of farther undergoing epipolic dispersion. There were only two liquids out of all those examined—namely, oil of turpentine and pyroxylic spirit—which, when interposed in the incident beams, act like the solutions of quinine in preventing the formation of the blue film; and the only solid in which the author discovered a similar power of epipolic dispersion is the green fluor of Alston Moor, and which by this action exhibits at its surface a fine deep blue color.—*Proc. Roy. Soc., Apl.* 10.

Ibid.

Statistics of Lowell Manufactures, January 1, 1844. *Compiled from authentic sources.*

Corporations.	Locks & Canals.	Merrimack.	Hamilton.	Appleton.	Lowell.	Middlesex.
Incorporated,	1792	1822	1825	1828	1828	1830
Commenced operations,	1822	1823	1825	1828	1828	1830
Capital Stock,	600,000	2,000,000	1,000,000	600,000	600,000	950,000
Number of Mills,	2 Shops, Smithy, Furnace.	5 & Print works.	3 & Print works.	2	2—1 cot., 1 carp.	2 & 2 Dyehouses
Spindles,		40,384	21,248	11,776	6600 cot., besi. wool	7200
Looms,		1300	590	400	152 cot., 50 power carpet, 40 hand do.	550
Females employed,		1250	650	340	400	250
Males employed,	500	550	250	65	200	250
Yards made per week,	1225 tons wrou't and cast iron	250,000	100,000	100,000	2500 Car. 150 Rugs, 85,000.	37 B'rdelo. 122 Cassim. 9000 Cassim. 1800 B'rdcloth.
Bales of Cotton used in do.,	per annum.	130	100	90	110	1,000,000 lb. wool per annum and 3,000,000 teasels.
Pounds of Cotton wrought in do.,	Machinery, R. R Cars & Engines.	56,000	42,000	36,000	40,000	
Yards dyed and printed do.,		210,000	63,000			
Kind of Goods made,	15,000 bushels charcoal, 200 chal. smith's coal, 400 tons hard coal.	Prints & Sheetings, No. 22 to 40.	Prints, Flannels, Sheetings, &c., No. 14 to 40.	Sheetings & Shirtings, 14.	Carpets, Rugs, & Negro Cloth.	Broadcloth and Cassimeres.
Tons Anthracite Coal per annum.	2300	5000	3000	300	500	600
Cords of Wood per annum,		200	500		500	1500
Gallons of Oil per annum,		13,000	6500	3440	Olive, 4000. Sperm, 4000.	Lard, 15,000 Sperm, 5000
Diameter of Water wheels,	13 ft.	30 ft.	13 ft.	13 ft.	13 ft.	17 and 21 ft.
Length of do. for each mill,	14 ft.	24 ft.	42 ft.	42 ft.	60 ft.	23 and 21 ft.
How Warmed,	Hot Air Furnace.	Steam.	Steam & H. Air.	Steam.	Hot Air Furnace.	Fur. and Steam.

Corporations.	Suffolk.	Tremont.	Lawrence.	Boott.	Massachusetts.	Total.
Incorporated,	1830	1830	1830	1835	1839	
Commenced operations,	1832	1832	1833–4	1836	1840	
Capital Stock,	600,000	600,000	1,500,000	1,200,000	1,200,000	10,650,000
Number of Mills,	2	2	5	4	4	33, exclusive Print-works &c.
Spindles,	11,776	11,520	32,640	31,524	27,008	201,076
Looms,	352	409	950	910	882	6194
Females employed,	340	360	900	780	725	6295
Males employed,	70	70	170	130	160	2345
Yards made per week,	90,000	115,000	210,000	180,000	260,000	1,425,800
Bales of Cotton used in do.,	90	75	180	145	200	1120
Pounds of Cotton wrought in do.,	32,000	30,000	65,000	59,000	80,000	440,000
Yards dyed and printed do.,						273,000
Kind of goods made,	Drillings, 14.	Sheetings & Shirtings, $\frac{1}{4}$	Printing Cloths, Sheet and Shirt No. 14 to 30.	Drillings, 14. Shirtings, 40. Print'g Cloth, 40.	Sheetings, 13. Shirtings, 14. Drillings, 14.	
Tons Anthracite Coal per annum,	300	250	650	750	750	12,500
Cords of Wood per annum,	70	60	120	70	70	3290
Gallons of Oil per annum,	3500	3692	8217	7100	7100	67,849
Diameter of Water-wheels,	13 ft.	13 ft.	17 ft.	17 ft.	17 ft.	
Length of do. for each mill,	42 ft.	42 ft.	60 ft.	60 ft.	60 ft.	
How warmed,	Steam.	Steam.	Steam.	Steam and H. A.	Steam.	

Yards of Cloth per annum,	74,141,600
Pounds of Cotton consumed,	22,880,000
Assuming half to be Upland, and half New Orleans and Alabama, the consumption in bales, 361 lbs. each, is	58,240

A pound of Cotton averages $3\frac{1}{8}$ yards.
100 lbs. Cotton will produce 89 lbs. Cloth.

Average wages of Females, clear of board, per week,	$1.75
Average wages of Males, clear of board, per day,	.70

Medium produce of a Loom, No. 14 yarn, 44 to 45 yards per day.
" " " No. 30 " 30 " "
Average per Spindle, $1\frac{1}{16}$ yards per day.

Average amount of wages paid per month,	$150,000
Consumption of Starch per annum, (lbs.)	800,000
Consumption of Flour for Starch in Mills, Print Works, and Bleachery, bbls. per annum,	4,000
Consumption of Charcoal, bushels per annum,	600,000

The Locks and Canals Machine Shop, included among the 33 Mills, can furnish Machinery complete for a Mill of 5000 Spindles in four months; and lumber and materials are always at command, with which to build or rebuild a Mill in that time, if required. When building Mills, the Locks and Canals Company employ directly and indirectly from 1000 to 1200 hands.

To the above-named principal establishments may be added, the Lowell Water-Proofing, connected with the Middlesex Manufacturing Company; the extensive Powder Mills of O. M. Whipple, Esq.; the Lowell Bleachery, with a capital of $50,000; Flannel Mill; Blanket Mill; Batting Mill; Paper Mill; Card and Whip Factory; Planing Machine; Reed Machine; Foundry; Grist and Saw Mills—together employing about 500 hands and a capital of $500,000.

With regard to the health of persons employed in the mills, six of the females out of ten enjoy better health than before entering the mills; and of the males, one-half derive the same advantage. In their moral condition and character, they are not inferior to any portion of the community.

A very considerable portion of the wages of the operatives are deposited in the Lowell Institution for Savings.

On some Photographic Phenomena. By Mr. Shaw.

The main object of Mr. Shaw's discourse was to communicate details of original investigations pursued by him for the purpose of isolating and determining some of the conditions which either accelerate or retard the decomposition by light of the salts of silver generally. Mr. Shaw first described the known process of the Daguerréotype, taking occasion to notice that the film of iodine of silver, formed on the silver plate, may have its sensitiveness to light greatly increased by exposure to the vapor of bromine or chlorine,—bromine being the most effectual agent for this purpose. The quantity of bromine, however, which communicates the greatest degree of sensitiveness is

extremely minute, and excess of it destroyed the photographic character of the plate, by inducing a change, which was subsequently described. The difficulty of ascertaining this quantity is removed by exposing the plate to the vapor of a mixture of iodine and bromine, until it receives a violet hue. Mr. Shaw then described the subsequent stages of the operation: the placing the plate in the camera obscura to receive the image, its subsequent exposure to the vapor of mercury, where the picture first developes itself, the subsequent removal of the film of iodine of silver by hypo-sulphite of soda, and, finally, the fixing the picture by a film of gold. The chemical and physical changes accompanying these processes were adverted to. Mr. Shaw then stated, that if an impressed Daguerréotype plate, after removal from the camera, and before introduction into the mercury box, be exposed to the vapor of chlorine, iodine, or bromine, however largely diluted with atmospheric air, the nascent picture is obliterated, so as to be no longer capable of development by the vapor of mercury. This fact, according to Mr. Shaw, has long been known, though a satisfactory explanation of it has hitherto been wanting. To obtain this explanation, Mr. Shaw directed his researches to the condition of the sensitive surface of the plate after the impression had been thus destroyed. By exposing some impressed plates, half covered by a metallic screen, to the vapor of bromine, and then placing them in the mercury box, Mr. Shaw found that both the covered and uncovered portions remained unchanged, but that an intensely white stain occurred in a line corresponding with the edge of the screen. This Mr. Shaw referred to the effects of light insinuating itself in the small space purposely left between the screen and the portion of the plate which it covered. From this experiment he established the fact, that when an impressed Daguerréotype surface is exposed to either of the vapors already spoken of, the virtual impression is on the one hand destroyed, and, on the other, the sensitiveness to light is restored. As to the degree in which chlorine, iodine and bromine are capable of restoring the original character of the Daguerréotype surface, it was ascertained that, after the development of the picture in the mercury box, the plate, if exposed to bromine, is again ready to receive an impression of light, even on the surface on which the mercury has condensed; so that a succession of pictures may be superimposed on each other on the same plate. Mr. Shaw also ascertained that full daylight is incapable of exciting any action on a sensitive surface in the presence of chlorine, iodine or bromine. From this circumstance was drawn the important practical conclusion, that the Daguerréotype artist need no longer prepare his sensitive plate in the dark, but may fearlessly permit the sun's light to fall on it while it is receiving its sensitive coating, if he takes the precaution of exposing it for an instant to the vapor of bromine or iodine before placing it in the dark box in which it is conveyed to the camera. This may be valuably applied when taking pictures of movable objects. If, during the time of the plate being in the camera, the object, by moving, becomes distorted, it is only necessary to expose the impressed plate for an instant to the vapor of chlorine,

iodine or bromine, and it will be restored in every respect to its original condition; and this process may be repeated until a perfect impression is obtained. Mr. Shaw then entered on some experiments instituted with the view of ascertaining the conditions which either accelerate or retard the decomposition of salts of silver generally by light. He stated that pure iodide of silver is not, as is generally supposed, sensitive to light, and that it only becomes so when one of the substances used in its preparation—*i. e.* nitrate of silver or iodide of potassium—is in excess. Mr. Shaw then proceeded to describe experiments on chloride of silver by light. The chloride used by him was obtained from the nitrate of silver and hydro-chloric acid. This salt having been spread on slips of glass, was secured in glass tubes containing an atmosphere of the gas selected for experiment. The tube was then exposed to daylight, and the consequent darkening of the chloride observed. These investigations led Mr. Shaw to the interesting discovery that chloride of silver, after having been darkened by light, when placed in the dark for two or three hours, reassumes its original whiteness, the chlorine combining under these circumstances with the reduced metal. On being again submitted to daylight, the chloride was again darkened, and again bleached by being placed in the dark: and Mr. Shaw proved that this alternate effect might be repeated indefinitely, without diminishing the sensitiveness of the salt. From this curious property of chloride of silver, Mr. Shaw was led to the construction of a photometer. In the course of his researches, Mr. Shaw arrived at another important discovery. He ascertained that some gases and vapors have a specific action on the chemical agency of light without reference to their colors. He observed that rays of light passing through a stratum of bromine had more influence on the chloride of silver than when they passed through an equal stratum of chlorine, notwithstanding the far deeper color of the former gas. Mr. Shaw concluded by describing another photometer, which, being constantly exposed to light, exhibits, by the change produced in it, the relative intensity of the light at the time of the observation. This instrument consists of a wedge-shaped glass vessel, filled with chlorine, and furnished with a long strip of glass, in the middle of which is a band of chloride of silver, the strips of glass being of an uniform grey color. When this instrument is exposed to light, the darkening commences on the lower end of the band of chloride of silver, and gradually progresses upwards, until the effect of the light is wholly counteracted by the retarding power of the gas through which it passes, and its contact with the salt. Mr. Shaw expressed his opinion that, by observations made on this instrument at regular intervals, a curve might be deduced, indicating the varying intensity of the light throughout the day.—*Proceed. Royal Institution, March* 14, 1845. Athenæum.

A notice respecting the cause of the beautiful White Rings which are seen round a luminous body when looked at through certain specimens of Calcareous Spar. *By* Sir David Brewster.

By varying the inclination of the spar, the rings increase and diminish, each of them in succession, contracting into a luminous spot and disappearing, and then expanding into rings as before. The two rings are produced from the two images formed by double refraction, and hence the light of one ring is oppositely polarized to that of the other. When the ordinary and extraordinary ray are refracted in lines parallel to the edge of the rhomb, which they are at different incidences, their respective rings disappear. At oblique incidences the rings are highly colored, and when the dispersive action is small they have a bright silvery whiteness. Sir David Brewster stated that they were produced by minute tubes in the mineral, of which there were many thousands in an inch, and that these tubes were parallel to one of the edges of the rhomb, viz: to that edge to which the refracted ray was parallel when each ring became a luminous spot.—*Proc. Brit. Assoc.* Ibid.

Practice of Electro-Metallurgy. *By* Mr. Napier.

Mr. Napier superintends the scientific department of the works of Messrs. Elkington. His present purpose was, not only to describe some curious points in the practice of electro-plating, but also to announce a new application of electricity in reducing metals from ores which, like that of copper, can be fused by a flux. 1. *As to Electro-plating:*— Mr. Napier commenced by noticing the known difference between solid and liquid conductors of electricity—*i. e.* that the latter are decomposed by the current which they convey; on this property the principle of all the electro processes rests. The mode in which the copper is deposited from the liquid sulphate on a surface connected with the zinc terminal of the battery was then illustrated theoretically by a diagram, and practically by a large sheet of cloth covered by these means. The object of this fabric is to furnish a roofing for houses, lining and ornamenting rooms, and covering railroad carriages;—not only water-proof, but also not liable to be set on fire by sparks falling on it. Mr. Napier here noticed the difficulty of maintaining that equable diffusion of the copper-salt through the solution which should insure the uniform deposit of the metal. This can only be effected by keeping either the liquid or the article in constant motion, or else by placing the latter horizontally at the bottom of the former—care being always taken to insure the solution being constantly saturated by suspending crystals of the salt in it. In plating goods with gold or silver, recourse is had to the cyanides of those metals. The preparation of the cyanide of potassium from the common yellow ferro-cyanide was described. This salt separates silver from the nitrate, and gold from the chloride, forming the required cyanide. An instantaneous gilding of several articles was effected before the audience. The subsequent processes of brushing and burnishing, by which the soundness of the work is tested, were then exhibited. 2. *As to the fabrication of solid silver articles:*—On a

model of metal, or plaster of Paris, or any other suitable material, is poured a compound of twelve parts of glue and three of treacle, melted together. This, when cooled, forms a perfectly flexible mould, from which any sculptured surface, even if there be much under-cutting on it, can be easily detached. Into a mould so prepared is poured a mixture of three parts tallow, one wax, and a half rosin. This dissolves at a low temperature; and when liquid, and previously to being poured into the mould, it receives half an ounce of phosphorus, dissolved in sulphuret of carbon. This, diffused through the melted mass thus described, gives it the property of reducing silver from its nitrate. The new model, then, taken from the mould, is moistened with nitrate of silver, and becomes covered with a thin film of that metal, on which copper is deposited by the battery-current. When this second mould is considered sufficiently thick, the fusible compound is melted away, the copper mould is protected at the back by non-conducting surface, generally a mixture of pitch and tar. Silver is then deposited within this mould, of any required solidity, from the solution of cyanide of silver and the battery-current; and, finally, the copper mould is dissolved by perchloride of iron, leaving the silver pure. By the same process, delicate organic textures are gilded. In all cases where it is desired to insure perfect metallic coating, the article (after having been washed with the sulphuret of carbon and phosphorus) is immersed first in a solution of nitrate of silver, and then of chloride of gold, both very dilute. 3. *As to the reduction of copper, &c., from their ores by electricity:*—Mr. Napier has proposed the following process for applying this discovery to practical purposes. He mixes the roasted ore with soda and lime, and places the whole on a bed of black lead tiles in a reverberatory furnace; these are connected with the zinc terminal of the battery, and the surface of the mass, when fused, is covered with an iron plate, which is put into connexion with the copper terminal. At the expiration of a period depending on the power of the battery, the complete extraction of the copper takes place, which is found collected at the bottom, amounting to, according to present experience, from twelve to sixteen times the weight of the zinc dissolved in the battery-cell. Whether these results are dependent throughout on the direct electrolysation of the fused mass, or if electrolysation be the primary effect, deranging the constitution of the compounds, and which, in connexion, with the intense heat, produces the results referred to, Mr. Napier cannot as yet say.—*Proceed. Roy. Ins., May* 2. Ibid.

On the Manufacture of Wire Ropes. By Mr. Carpmael.

This manufacture has grown up within the last four or five years. Till the year 1839–40 there were no real wire-ropes in this country, *i. e.* no manipulation of wire, first producing strands, and then combining these strands into a single rope. Mr. Carpmael briefly noticed the improvements which had been made in the manufacture of hempen cordage during the last fifty years. He laid great stress on Captain Huddart's contrivance for varying the length of the yarns,

according to their distance from the centre of the rope, so that each, throughout its course, being kept at the same distance from the central strand, was subjected more nearly to the same amount of tension. The characteristic difference between the mechanical principles of the manufacture of the hempen and the wire-rope was then inculcated. *Twisting is essential to the structure of the former, but would be destructive of the latter fabric.* This principle, long overlooked, was discovered by Mr. Newall, the patentee of the improved wire-rope, and the object of his machinery is to carry that principle into effect. The wire-rope consists of a hempen core, the horizontal section of which exhibits seven equal circles,—six round a central one; these, according to a known geometrical law, touch the central circle, and also each other. Round this central core are six strands, formed exactly in the same way, except that while the central core is of hemp, (as is the core of the rope,) it is surrounded by six wires, —the diameters of these wires being equal to those of the yarns of the core; so that a section of the rope exhibits forty-nine equal circles, (thirty-six wire and thirteen hemp,) arranged in a sort of hexagonal form, the lines joining the centres of the hempen cores of each strand, producing a regular hexagon. Having exhibited the machines by which Mr. Newall *lays* the wires in the strands, avoiding all *twist*, Mr. Carpmael stated some of the purposes to which this manufacture had been applied. He premised, that the greatest strength is obtained when wire made of *hard* iron is used. Ropes thus manufactured are stronger, lighter, and cheaper, than hempen cordage bearing equal weights; consequently, when materials are raised from a depth in mines, a heavier load may be lifted with equal power whenever the wire-rope is used. For the same reason, this fabric is preferable in the fixed rigging of ships; and its value for railway purposes has been proved by decisive tests. As long as hempen ropes were used on the Blackwall Railway, there were often two or three breakages a-day. Since these have been superseded by the iron-wire, there have not occurred more than twelve fractures in twelve months, and during six thousand journeys.—*Proceed. Royal Inst., May* 9. Ibid.

On the Electricity of Plants in the several Stages of their Development. By Rev. E. Sidney.

At the commencement, and at each division of this communication, Mr. Sidney dwelt on his desire to be considered, not as the promulgator of any theory on the influence of electricity on vegetable growth, but as the cautious observer of important and instructive facts. The following six propositions were maintained:—First, *Electricity appears to exercise an influence on growing plants.* After noticing the experiments of Maimbray, Nollett, Bertholon, Davy, and others, Mr. Sidney mentioned that he had himself accelerated the growth of a hyacinth in a common glass jar by giving it sparks, on alternate days from the machine. Secondly, *Fluids contained in vegetable*

tissues possess a high conducting energy, as compared with the ordinary substances found on the earth's surface. In confirmation of this, several experiments were shown to prove the conducting energy of vegetable points. The fact was also stated, that it was impossible to give an electric shock to more than one at each extremity of a circle of persons standing on a *grass-plat*. This the aperator easily did when they transferred themselves to a *gravel-walk*. In the former instance, the current went across the grass, instead of being carried from one human body to another. A jar, of forty-six square inches of coated surface, was discharged by a blade of grass in little more than four minutes of time, whereas it required three times that period to produce the same effect by means of a metallic needle. Mr. Sidney said, however, that probably the blade of grass had many points. Mr. Sidney also showed a drawing of Mr. Weekes's Electroscope with vegetable points, which Mr. Weekes prefers to any artificial ones he has yet tried in the open air during the passage of a cloud. Thirdly, ***There are indications of adaptation to electrical influences in the differences of form of parts of plants in the different stages of their development.*** Thus the moistened germ of a vegetating seed becomes a good conductor. The ascending and descending portions are, in the majority of instances, pointed. Plants designed for a rapid growth have generally a strong pubescence. Those destined to meet the variations of the seasons have often thorns or prickles. As surface becomes needed for other purposes, the pointed is changed to the expansive form of the vegetable organ. As the period of fruiting approaches, it seems desirable that electricity should be carried off. Hence the hairs, &c., fall off or dry away. The apparent exception is that of *pappi*, which have a special office for conveyance of seeds. Gardeners put metallic hoops over fruiting melons which tends to take off electricity and shade them. Fourthly, Mr. Sidney inquired, ***Whether there are not natural phenomena tending to confirm these views?*** Vines and hops are said to grow rapidly during, and after, a thunderstorm, and peas to pod after a tempest. As to hops, these effects may be ascribed to the destruction of aphides, &c., by the lightning: but as these animals are tenacious of life, the storm which destroyed the parasitic insect, would probably also kill the plant which fed it. Again, it is observed, that there are no plants wherever simooms, which appear to result from a highly electrical state of the atmosphere, occur. Mr. Brydone's observation of the presence of electricity in the atmosphere of Mount Etna, in places where vegetation was absent, and its deficiency wherever vegetation luxuriated, also indicated the influence of plants in distributing atmospheric electricity. This was illustrated by an experiment with a cone of chalk, with a piece of moss on one part. The part without the moss brought near the machine, only slightly affected the electrometer. The moss carried off the electricity entirely. Fifthly, Mr. Sidney suggested the inquiry, ***Whether the forms and geographical distribution of certain species of plants did not indicate design with reference to their electrical properties and uses.*** The prevalence of the fir tribes in high latitudes was noted. These trees are

characterised by their needle-shaped foliage, and it was argued that the conducting power, with which this form invested them, might modify dryness and cold, and aid in the precipitation of snow. Mr. Sidney concluded by suggesting *modes of applying electricity to practical agriculture and horticulture.* First, *with regard to the free electricity in the atmosphere.* Having mentioned the experiments of Mr. Foster, of Finbrassie, on growing crops, Mr. Sidney described modifications of this arrangement made by Prof. E. Solly, in his experiments at the Horticultural Garden, and by himself. The latter consist of wires suspended over the growing crop from other wires which are kept parallel to the horizon by being fastened to insulated rods. Secondly, *Electricity artificially generated by the voltaic pile.* Mr. Sidney has found that potatoes, mustard and cress, cinerarias, fuchsias, and other plants, have their development, and, in some instances, their productiveness, increased by being made to grow between a copper and a zinc plate connected by a conducting wire; while, on the other hand, geraniums and balsams are destroyed by the same influence. Mr. Sidney at present believes that the application of electricity to vegetable growth may be made available in horticulture. The question as to agriculture may be decided when more experiments are tried, and the philosophy of the experiments fully determined.—*Proceed. Roy. Soc., May* 16. Athenæum.

Exhibition of French Arts and Manufactures at a Meeting of the Philosophical Society of Glasgow.

At a late meeting of the Philosophical Society of Glasgow, specimens were exhibited of French art and manufacture, purchased by Government at the late Exposition in Paris for the School of Design in London, and which have been sent down for inspection to the Institution in Glasgow. These articles are described as presenting a high standard of excellence in various branches of art and manufacture. "The first we noticed," says the *Scottish Guardian*, "was a drawing or pattern for a rug, being a specimen of the manner in which French designs are executed for the manufacture of these articles. It might be about twelve inches long, by about six or eight in breadth, and consisted of a series of figures of flowers, drawn and colored with exquisite skill, finished with the minuteness and nicety of miniature painting, and showing an amount of labor which we were informed would be poorly compensated to the artist by fourteen guineas, the price at which the pattern was purchased. There were a number of specimens of pottery, and glass manufacture, and jars and vases cast in metal, remarkable for their classic elegance of form and beauty of design. Amongst these we observed the following: A valuable bronze vase, with an allegorical design, representing two groups of figures, the most prominent of which were Justice and Peace on one side, and Patience and Hope on the other, all the figures being produced with admirable sculpturesque effect. A jar in common Beauvais ware—the coarsest potter's clay, in fact—showed in a remarkable manner the value of Art in moulding forms of perfect

grace and symmetry out of the most ordinary and inexpensive materials. One of these elegant jars might cost sixpence, and we believe that in France, as we have no doubt will soon be the case in this country also, they are much sought after for household purposes. A vase cast in argent-platina, of singularly fine proportions; the chasing elaborated with the minuteness of insect-work; produced in the *atelier* of M. Rudof; cost forty guineas, being considered a perfect specimen of the art, and without its equal as yet in British manufacture. Glass-china vase, from the work called Choisi le Roi; value, 16*l.* In this specimen the classical proportions of the other vases were produced in a material of exquisite delicacy, combining the purity of crystal with the pearly whiteness and transparency of the finest porcelain, and affording a ground susceptible to the minutest shades of the pencil. Vases of this description are painted by the hands of ladies; and the present specimen bore testimony to the industry and taste with which the paintings are executed. Two Terra Cottas, moulded in common tile-clay, and intended for holding flowers;—both very pretty examples of the same union of taste and economy which we have already noticed. Four specimens of enameled ware, another cheap and beautiful invention, applicable to a variety of purposes, such as plates, dishes, and other articles made of earthenware. The figures are moulded in *intaglio*, instead of in *bas-relief*, and the mould may be wrought by any man who can make bricks and tiles, and with equal ease and expedition. When the cast is hardened, it is covered with a coat of enamel or varnish, in the usual way; and the lowest lines or hollows of the *intaglio* being designed to throw up the shaded parts of the picture, they receive the thickest coating of varnish, while the more elevated lines take on the least; and the mixture of light and shade thus produced is so well managed as to give the picture all the prominence to the eye of *bas-relief*. Amongst the more finished and valuable specimens of porcelain manufacture was the Adelaide Vase, painted in enamel, in imitation of Middle-Age Art, the painting, as in a former instance, being done with the pencil. We also noticed a slab of lava, enameled and painted in a beautiful manner; and learned that slabs of this seemingly impracticable material are now used in Paris for the purpose of painting on their enameled surface the names of the streets. They are thus rendered impervious to atmospheric influence, and are considered indestructible. Amongst the other casts in metal were part of a bronze architrave of the door of the church of the Magdalene at Paris, and casts of ornamented outer plates of locks, in iron and in brass, cleverly designed and moulded; besides a variety of bronze figures, &c. Some ingenious specimens were also shown of carving in leather, in imitation of casting; and specimens of the ornamental flooring used in the houses in France, where they have no carpets. But the French are rapidly acquiring a taste for this domestic luxury, and have fairly commenced the manufacture of carpeting, which promises soon to become an item of great importance in the trade of the country. Considerable attention was paid to a specimen of their carpeting exhibited in the room, and which exceeded ours as much in the beauty

of the pattern, as it it fell short of the British manufacture in the fineness of the fabric. In like manner, the white damask table-cloth was unknown in France eight years ago, but is now both manufactured and used in the country; and a specimen exhibited on the present occasion evinced still greater progress than in the case of the carpet manufacture. But however deficient the French may be in the production of these articles, as compared with our own manufactures, the profuse display of gorgeous damask silk, from the factories of Tours and Lyons, must have challenged universal admiration by the superiority of their fabric and designs. Some of the richest effects were brought out in these manufactures by using glass thread, which is prepared so fine as to be capable of being tied in knots without breaking, and woven in every respect like ordinary thread. But the fabric which excited the strongest interest, both on account of its beauty and its novelty and ingenuity, was a large square of wool mosaic, or India-rubber cloth, a manufacture peculiar to France and some parts of Germany. The pattern was perhaps the most perfect in respect of design of any work of Art in the exhibition. The flowers and leaves were copies from nature, and were much admired for their botanical accuracy. Even the least prominent of the plants represented in the composition, such as the fronds or leaves of ferns, were delineated with so much fidelity as to enable botanists to distinguish the different species, and give them their specific names! The triumph of Art in this instance is the more remarkable, that after the designs passed from the hands of the pattern-drawer, it was wrought into the fabric by one of the most complicated processes that can well be imagined. The pattern is in fact produced in the fabric by the *ends* of threads standing out transversely from the foundation of India-rubber cloth, and not, as is usually the case, by the threads being interwoven longitudinally. The cloth is sold at 5*l.* a yard."

Athenæum.

On the Flexure of a Uniform Bar supported by a number of equal pressures applied at equi-distant points, and on the positions proper for the application of these pressures, in order to prevent any sensible alteration of the length of the bar by small flexure. *By* G. B. Airy, Esq.

In the use of standards of length, two points have gradually attracted more and more of attention—the application of supports in such a manner as to produce no irregularities of flexure, and the application of such supports as will permit the standard freely to yield to the expansive or contractive effects of temperature. Since these points were insisted on by Captain Kater and Mr. Baily, the principle adopted in the support of standards has been to sustain them upon two rollers in a definite position. In whatever way a bar be supported, flexure must be tolerated; and the only points aimed at are, that it shall produce no sensible effects on the measured length, or that it shall always be the same. Several bars in use are notched at the ends to the centre of their thickness, and the defining points are

in the axis of the bar; and in these cases there is good reason to believe that the effects of any flexure are nearly insensible. In the standard scale of this society, the divisions are upon the upper surface, and the interval between these is not unaffected by flexure. In this case there may be some fear of the bar acquiring a permanent flexure, but this may be checked by an examination of the divisions which Mr. Baily caused to be cut upon the other sides of the cylinder. Still it is necessary to be assured that, as far as the best theories of flexure enable us to judge, the upper surface is not sensibly lengthened or shortened. Very simple considerations will convince us that bars supported on two rollers, placed at the distance of one-fourth of the length from each end, must have the length of their upper surface necessarily elongated. The ill effects of this elongation are nearly obviated in the geodetic standards, which are notched to the centre; and may be considered as discoverable in the Society's scale by the use of the divisions on the opposite side. But it was the wish of the members of the committee of superintendence of the national standards, not only to place the divisions in or near to the axis of the bar, by which means the *effect* of flexure would be obviated, but also to make the actual flexure as small as possible by a proper choice of the points of support. It was also recognized as a desirable principle, that the bar should be subject to as little strain as possible, and, therefore, that it should be supported at numerous points. Great facility is given to the arrangements for supporting a bar with definite pressures applied at special points, by the use of levers. Thus, if any portion of the bar rest upon two rollers which are placed at the ends of a lever, and if the fulcrum of a lever (whether movable or not) be in its centre, the pressures upwards produced by these rollers will necessarily be equal. If there be another such lever, and if the fulcra of this and the former be upon the extremities of a third lever, and if its fulcrum be at its centre, then the pressures upwards produced by the four rollers will be equal. By this arrangement of rollers and levers, one-half of the bar may be supported. If another similar system be applied to support the other half of the bar, the pressures produced by its four rollers will also be equal among themselves; and if the bar be laid symmetrically upon them all, the individual pressures will be equal. In this manner, by altering the lengths of the arms of the levers, any number of pressures, bearing any proportion to each other, and applied at any points whatever, may be produced. And the levers may be so arranged as to occupy a very small space. Mr. Baily decided on the application of eight rollers for the support of the national standard; and the author undertook to investigate the positions of the rollers which, supposing the pressures and the intervals equal, would so sustain the bar that its surface should not be sensibly lengthened. In the progress of the investigation, he was struck with an analogy in the results for two, for four, and for eight rollers, which seemed to indicate that the process could easily be generalized; and, on trying it in the general form, it proved to be exactly what he expected. The author goes on to describe the nature of the investigation, which is as follows.—It is

first assumed, that the flexure is so small that the mere curvature of a neutral line will not produce a sensible alteration in its length; that the extension of a surface is proportional to the momentum of the bending force; and that, when the momenta are equal, the extension produced by a bending force downwards, and the contraction produced by a bending force upwards, are equal. The method of applying these assumptions is to estimate the curvature at any point, by conceiving the section of the bar at that point, and the whole of the bar on one side of that point, to be held perfectly firm; and then to use the algebraic sum of the momentum of the weight of the remaining part of the bar downwards, and of the momentum of the supporting pressures under that part of the bar upwards, as the representation of the molecular extension in the neighborhood of that section. From this statement it will easily be seen that the curvature of the bar is expressed by a discontinuous function. In shifting our ideal section gradually from one support to another, the momentum produced by the weight of the portion of the bar increases continuously; as also does the momentum of the pressures of the supports; and, therefore, through that portion of the bar the change of curvature is continuous. But on passing a new support, although the change in the momentum of the weight of the portion of the bar, and the change in the momentum of the pressures of the former supports, are both continuous, yet there is now suddenly introduced a new pressure; and this interrupts the continuity of the change. From this consideration it appears that, between two supports, the whole effect of the molecular extension and contraction, as produced by curvature, is to be found by integration; but that, when this integration is performed, the whole of the various parts can only be combined by summation. These remarks are common to every method of supporting a bar. But when the supporting pressures are all equal, and their points of application are equally distant, the summation to which allusion is made can, for all the intervals between the supports, be effected by the processes of the calculus of differences. For the parts exterior to terminal supports, these processes will not apply. The author then proceeds with the mathematical investigation of the general expression for the extension of surface of the portion of the bar lying between any two of its contiguous supports.—*Proceed. Astron. Soc., Jan.* 10. Athenæum.

Ivory Engraving, or Durertype—a newly-invented process. By Henry Dircks.

Great as are the improvements which have been made in the art of engraving, there is no reason to believe we have yet arrived at perfection in any of its various departments. For a considerable period no method besides that of wood-engraving was known as suitable for printing along with type. Stereotyping, though it affords a metallic duplicate of the engraved wood block, and is so far useful for multiplying such works, yet is of no avail in the production of

original designs, and it was not until we were made acquainted with Gypsography and Glyphography, that we were put in possession of methods at all likely to compete with, if not supersede, wood engraving.

It is not my object to extend my remarks to those other methods of engraving applying to copper, steel, stone, &c., which even those most superficially acquainted with typography must be aware cannot be printed off along with letter-press. An early partiality for typographical works made me long desirous of re-discovering the supposed peculiar art by which Albert Durer produced those remarkable effects, particularly in cross-hatching, which have perplexed all who studied his prints, and have been the fruitful source of much speculation whether they are from true wood engravings, or absolute copper-plates, with all the lines in relief, the result of biting-in with nitric acid; thus etching the lights, instead of, as usual, etching the shadows, or lines to be printed. It may not be known to the general reader, that the shading produced by cross-hatching has ever been one of the principal difficulties in the art of wood engraving, not from its impossibility, but its extreme tediousness; and is, therefore, in all old prints particularly, very sparingly introduced, and much oftener entirely omitted. The frequent interlacing, or cross-hatching, as well as the spirited freedom of his lines, form a remarkable feature in Albert Durer's engravings. It was in 1837 that I designed a means of surmounting the main difficulty of the cross-hatching, which I could produce with the greatest freedom, either as an original effect, or to copy, as I then did, one of Albert Durer's prints. At that time the electrotype process was not known, or I should have employed it for one part of my invention, instead of stereotyping, which I found it requisite to abandon, as involving too much difficulty, labor, and expense. My method of engraving calls in aid either stereotyping or electrotyping. Its peculiarity is the facility it affords for *copying*, without any great skill on the part of the copyist. Indeed, in this respect it probably offers a dangerous temptation to the committal of forgery. Though myself a mere amateur, I have copied a print of Albert Durer's with all the exactitude that a steady hand could pass a tracer over lines already prepared. How much superior, however, must be the labor of one skilled in engraving. My method is as follows:

1. I take a plate of clear, thin, flatted glass, round the edge of which is to be pasted a ribbon of card, one quarter of an inch broad, flat to the glass, and close to its outer edge, forming a white margin, or frame, all round; a few drops of spirits of turpentine are to be rubbed over the glass, but on the card side only; next melt a little pure white bees'-wax, and holding the glass, if small, over a lamp, or a larger one over a chafing dish, pour upon it the wax, allowing all the superfluous portion to run over the card margin, the object being not to have it anywhere thicker than the card. The turpentine causes it to be very adhesive.

2. The glass thus prepared may be laid, with the varnished side

uppermost, on any print, which will appear distinctly through the wax varnish, and in this state is ready for copying with the graver.

3. The needles, or gravers, I propose using, may be of ivory, (and hence, or from Durer's name, may be chosen a distinctive title for this invention;) the softness and thinness of the coating, as also the smoothness of the glossy surface, favoring their employment. For open-lined engravings like Albert Durer's, maps, plans, and the like, ivory needles would answer every purpose, and without scratching the glass. To copy a fine copper-plate might require a steel point. The varnish is merely cut through, as in etching copper-plate.

4. A cast off the glass plate so prepared is what is next most wanted; and it was here my original difficulty occurred. By the electrotype process a copper printing block may be at once obtained, backed with soft metal, and raised on wood.

Such is my method, which a variety of circumstances have concurred to frustrate my bringing forward, but chiefly the want of sufficient leisure to prepare suitable specimens. That in the hands of able artists its capabilities are very surprising, I feel satisfied, and its affording an extremely easy means of copying, to those who are entirely amateurs at engraving, or drawing, is self-evident; arising from its not requiring the *reversing* of objects. Thus the ancient method of absolutely writing with a stiletto on a wax tablet, may now be advantageously revived, and when electrotyped may even be printed with letter press. Prints on paper, silk, cotton, &c.; pencil drawings, writing, embroidery, leaves of plants, medals, &c., may all be exactly traced by placing them under the glass plate, saving all the tediousness of first drawing and then etching. Some time back I intimated to private friends, what I still think might be carried out, that my method of engraving offers a light and suitable employment for females, who might be advantageously occupied in coppying for the electrotypist.

Before concluding, I wish to observe that my invention may, on a hasty glance, appear similar to, or even seem to be borrowed from, the Gypsographic and Glyphographic processes. But such is not the case. The only similarity is that of cutting down through a soft substance to a hard one; and the publication of those methods has certainly, so far, deprived me of the credit I might earlier have obtained for that useful part of the invention, of which no advantage had at that period been taken. But as regards employing a *transparent medium*, I believe my method distinctly stands alone. I can only say, in reference to my own knowledge of it, it is perfectly original in every respect; and I shall be sincerely pleased should these few hints be found serviceable in at all advancing an art I much admire.

January 5th, 1845.

The favorable reception which my paper, in the *Athenæum* of the 11th ult., has met with, induces me, first, to extend my remarks on Ivory Engraving, or Durertype; and, secondly, to add observations on a hitherto unpublished process for obtaining a transfer to the copper-plate to be engraved.

I. The perfections of the Durertype will depend much on the thinness both of the glass and the wax varnish. A very beautiful and thin glass is prepared in small plates for microscopic purposes, and which might be used for very fine engravings, not exceeding four to six inches square, while for larger subjects the flatted window glass would have to be substituted. Engravings which entirely cover the wax surface with lines require no further preparations than metallizing the surface with the finest black lead or bronze powder, and submitting the work, so prepared, to galvanic action in a proper electrotyping apparatus. When the engraving presents large white spaces, the wax in such parts should be thickened with a preparation of melted wax, by which means the electrotype produced from such surface will present indentations of the required depth in the electrotype cast. It does not occur to amateurs that the engraved wax is absolutely the *mould*, and that the electrotype itself forms the face of the printing block. One of the periodicals, last month, states that this "alleged invention" is "identical in all its material features with that known under the name of Glyphography," and yet the writer entitles the article a "new method of *copying* engravings." The peculiarity of my process, as before stated, is a facility in *copying* by employing a *transparent* medium; let my invention be judged by what I propose, and then I am sure its "identity" with Glyphography will disappear. As I admire the Glyphographic process I may state, without disparagement of that mode of engraving, that it does not of itself afford any facility whatever in *copying* engravings, and like all other kinds of engravings, it requires a transfer, by hand, or mechanically, of the subject to be copied. By the Durertype process the engraved copy is made at once, direct from the original, with the graver, no previous transfer of outlines being of any utility. The essential principle of Glyphography consists in cutting through a soft substance down to a metallic, and therefore opaque plate; my process substitutes a glass, or transparent plate. Thus differing materially and avoiding altogether the tediousness of first copying an original with the pencil, and then engraving the lines so drawn out.

As every art must be expected to be somewhat rude while in its infancy, I may reasonably surmise, that in the progress of the application of the means I have suggested, it will be found possible, by proper and delicate management, to lay exceedingly thin waxed glass on a Daguerréotype plate, and copy much of the magic picture as penciled by nature herself! Mr. C. J. Jordan, the talented discoverer of Electro-metallurgy, and himself a printer, suggests the employment of my Durertype plate, as a substitute for the ground glass in the camera obscura, to be there engraved.

II. The transferring of a drawing or engraving to a copper-plate can be attained by a very simple process, the phenomena of which does not appear very explicable; and is no doubt capable of being considerably extended and varied. I give the result as mentioned to me by a friend. He put into my hands a highly polished copper-plate, the surface of which presents a reversed impression of a copper-plate engraving as taken from paper, without in the slightest de-

gree affecting the original. I have had the copper by me a fortnight, and see no change; names that were printed on the paper may still be read backwards on the copper, presenting an excellent outline to guide the artist in the employment of his graver. This singular effect, I feel pleasure in adding, may be produced without difficulty or expense. Take a well polished copper-plate of the dimensions required for engraving a copy the exact size of the original: lay the drawn, written, or printed original with its face against the bright copper; fold a sheet of paper over it to keep it from shifting; place it under a weight to press the paper everywhere evenly against the copper, and rest it on a hot plate, stove, or even the hob of a fire-grate, for about ten minutes, in which time having acquired a moderate heat it must be removed. When opened out, the transfer will be found complete and perfect, if the operation has been properly conducted, which only experience can dictate. If too hot, it vanishes altogether, and if too cool, the lines are ill-defined. When obtained sufficiently perfect, it may be brought out still better by the vapor of iodine, or mercury, or even by simply breathing upon the plate.

In experimenting with a slip cut from a newspaper, it was curious to observe on the copper the confusion produced by the double printed surfaces of the paper. Anything written with common ink affords a very distinct transfer. The darkening effect of the slightest taint of ammonia on the paper would lead to the supposition that a chemical preparation of the ink might be provided, capable of giving a more vivid character to the transferred print. It is also possible that other polished metallic surfaces may be equally well acted on; the application of the heat may be varied by using a hot-press. The beauty and advantages of this singular property possessed by heated polished plates, in contact with printed paper,* is, that the original suffers not the slightest deterioration, while the truth of the transfer is insured by close contact with the surface to be afterwards engraved. I shall perhaps be better understood by instancing the usual mode of transfer to an etching ground on the surface of which, and *not* on the copper, the transfer is made; but by the Calorotype process, (as I think it may be with propriety called,) every line must be a faithful transfer from the original to the copper surface, so much so that two skilful engravers might produce independent copper-plates, the prints from which would not be distinguishable, the one from the other. This process would have great advantages where it was desirable to print *engravings* in colors, because, any subject being transferred wholly to a given number of plates, only such lines as would be wanted for printing red, need be engraved on one plate, all those lines for blue on another, all for brown on a third, and so on with a separate plate for each color employed. Indeed my own process of Ivory engraving, or Durertype, offers the same advantage, with the additional one of giving a raised surface.

The increasing demand for illustrated works and ornamental printing deserves every encouragement that can be devised, and must, I

* I should, however, mention that a polished copper-plate, kept a day or two in contact only, with a print, also acquires a pretty good impression.

conceive, proportionably render each contribution valuable that tends in any way to popularize such productions. I confess it has been with the hope of adding at least some little to the general store of typographical information, that I have again ventured to come forward with suggestions for further improvements.

HENRY DIRCKS.

February 1*st*, 1845. Athenæum.

Aeriferous Millstones.

M. Guevin Bonchon and Company sent to the Exposition of France several millstones. Among them was one of Train's aëriferous millstones, the arrangement of which allows the circulation of cold air under the millstones, in order to prevent the heating, which so often does injury to the grist. These millstones are generally 1.3 metre (4 ft. 3 in.) in diameter, and are thus formed. Four orifices,

Fig. 1.

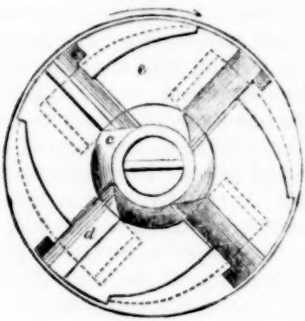
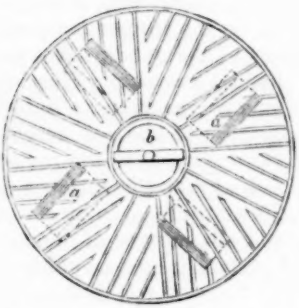


Fig. 2.



a, *a*, starting from near the centre of the millstone to within 5½ inches of the periphery, and pierced sloping, are made through the whole thickness of the stone. The mill is provided in the centre with a cast iron eye or box, *b*, in the form of a cone reversed, and on its external part a wrought iron circle, *c*, covering by about 8 inches the upper surface of the millstone. Iron plates, *d*, are strongly rivetted on to the iron eye and circle, some inclined 45° over the orifices, others forming quadrants of curves, *e*, perpendicular to the great circle, and serving to lead the air, which is thus forced to pass into the orifices, *a*. By these means a current of air is produced by the rotation of the millstone. Civ. Eng. and Arc. Jour.

Improvement in the Manufacture of Glass for Optical Purposes.

At the Society of Arts, last week, a paper, by Mr. Claudet, "On Improvements in the Manufacture of Glass for Optical Purposes," was read. Heretofore the manufacture of glass fit for the purpose of the optician has been a matter involving great uncertainty and difficulty. About 1744, a Swiss, named Guinand, in making some ex-

periments in the construction of the telescope, was led to endeavor to make glass for himself, and from his labors arose the first process by which glass could be made with certainty sufficiently good in quality for the construction of optical instruments. With the death of Guinand his secret was partially lost. The invention which forms the subject of Mr. Claudet's paper is founded upon the process of Guinand, and is due to a French glass manufacturer named Botemps, whose attention was first drawn to the subject by the son of Guinand himself. The chief defect in optical glass consisted in striæ and spots; these arose from the great difficulty of properly mixing the materials when in a state of fusion; it was impossible to stir the melted mass, because the temperature was so high as to destroy instruments of metal, and besides by introducing them into the glass it would have been tinged with color, according to the nature of the metal employed. The method used by M. Bontemps is to introduce the iron rod used in stirring into a clay cylinder closed at one end, so that the glass is entirely protected from the injurious action of the iron; the ingredients are thus effectually mingled; the glass is then suffered to cool gradually, the crucible broken with care, and the mass sawed transversely into slices, so that lenses may be obtained of the diameter of the crucible. Very large lenses have been produced by these means, and two of about three feet in diameter are now in progress of manufacture for the Royal Observatory at Paris. Mec. Mag.

Process of Anastatic Printing. *By* Prof. Farraday.

Anastatic printing is the ἀνάστασις (the fresh raising up) of copies from a printed sheet of paper. This, by the process described, may be done to an indefinite extent. The philosophy of this process and its practice were explained and exhibited. The philosophy of the Anastatic printing rests on a few known properties of the articles employed. Thus, *water attracts water, and oil, oil; though each mutually repels the other. Metals are much more easily wetted with oil than with water, but they will readily be moistened by a weak solution of gum;* and, finally, *this property, of their becoming wet by water, is greatly increased by phosphatic acid.* To these properties of oil, water, and the metals, may be added, as one of the principles of Anastatic printing, *the readiness with which part of the ink of any newly printed book or engraving can be transferred by pressure to any smooth surface beneath.* If, for example, a corner of a newspaper be fixed on a white sheet of paper, and then pressed, or rubbed with a paper-knife, the letters will be distinctly seen in reverse on the paper. This effect is known to book-binders, and our readers may have seen, especially in the case of books bound soon after publication, pages disfigured by the "*setting off*," or transfer of the ink of the opposite page. Such being the properties of the matters concerned in Anastatic printing, the process is simple. The printed paper, whether letter-press or engraving, is first moistened with dilute nitric acid, and then pressed with considerable force, by a roller, on a perfectly clean surface of zinc. By this means every

part of the sheet of paper is brought into contact with the plate of zinc. The acid, with which the unprinted part of the paper is saturated, *etches* the metal, and the printed portion *sets off* on it in the manner already described, so that the zinc surface presents a complete reverse-copy of the work. The principles before specified are now brought into operation. The zinc plate, thus prepared, is washed with a solution of gum in weak phosphatic acid. This liquid is attracted by the etched surface, which it freely wets, while it is repelled by the oil of the ink in which the writing or drawing on the plate is traced. A leathern roller, covered with ink, is then passed over the plate, when a converse effect ensues. The repulsion between the oily ink and the watery surface over which the roller passes, prevents any soiling of the *unfigured parts* of the zinc plate, while the attraction between oil and oil causes the ink to be distributed over the *printed portions*. In this condition the Anastatic plate is complete, and impressions are pulled from it in the common lithographic process. Mr. Faraday concluded his description by stating, that when it was required to apply the Anastatic printing to very old originals, which do not *set off* their ink on pressure, the following expedient was resorted to: The page, or print, is soaked in a solution, first of potass, then of tartaric acid. This produces a perfect diffusion of minute crystals of bi-tartrate of potass through the texture of the unprinted part of the paper. As this salt resists oil, the ink-roller may now be passed over the surface without transferring any of its contents, except to the printed parts. The tartrate is then washed out of the paper, and the operation proceeded with as before, commencing with the moistening by nitric acid. During the description of the process, a complete Anastatic copy of a page of a printed work, with wood-cuts, was made by Mr. Woods, who had brought his press and workmen.—*Proceed. Royal Inst., April* 25, 1845.

Ibid.

Description of a Self-Registering Thermometer. By Mr. Mansfield Harrison. *Communicated to the Royal Society April* 17*th*, 1845.

The instrument here described is composed of two parallel bars, the one of iron and the other of copper, united at their lower end, and registering their differences of expansion by heat, by means of a series of multiplying levers, carrying a pencil which is made to press on paper wound round a cylinder moved by clock-work.

Lond., Edinb., and Dubl. Philos. Mag.